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THE SALEM FIRE.

To the engineer every conflagration has its lessons, and the disastrous fire which destroyed nearly half of Salem, Mass., last week, is no exception in its instructiveness. The electric service of this famous old city is furnished by the Salem Electric Lighting Company, one of the properties of the well known Tenney syndicate of Boston. That the people of Salem are not without central-station service today is due to a wise engineering foresight which not long ago resulted in carrying out a scheme of plant reconstruction along fireproof lines which splendidly met the test when it came. The fire started in a distant part of the city. Fanned by a strong wind, the blaze carried everything before it, laying more than a thousand buildings in ruins before its course was finally stayed. Some six hours after the conflagration started, the flames swept down upon the lighting company's station, surrounded it, beat against its brick walls and wire-glass windows with a fury which only those on the spot can appreciate, and then passed on leaving every other structure in the vicinity a heap of smoking ashes and debris.

Some damage was done to the coal conveyor, but the five employees who remained in the station during its ordeal of fire kept steam on the boilers and ran an exciter at normal voltage. There was nothing for the main generating units to do, as the outgoing lines in the vicinity of the plant were gone; but during the night following the conflagration, street-lighting service was resumed through a considerable portion of the city and commercial lighting and power began to be supplied. Within 48 hours of the start of the fire, the company was supplying electricity to nearly everyone in town who was in a position to receive service, through temporary mains run to the more important centers of distribution adjacent to the station. The manager of the company and a number of other employees lost their homes, but with dauntless courage every man attacked the problem of restoring the service at the earliest possible moment. The resources of the Tenney organization, with its strong centralized engineering and purchasing facilities, its capable management and alert staff of employees of adjacent companies in Malden and elsewhere, were an important factor in the quick resumption of operations, and the immediately proffered aid of many other central stations in Eastern New England, and the instant response of supply dealers and contractors to emergency demands for material, should not be overlooked in the restoration of service.

Too much credit cannot be given to the foresight which was willing to spend some good money before the emergency came in putting the station into a genuinely fireproof condition. Without this, the public would now be suffering a degree of inconvenience not easily exaggerated, in addition to the heavy burdens imposed by the disaster as a whole. The work of the militia, which took charge of affairs early in the evening of the day on which the fire started, would have been handicapped almost beyond measure; the resumption of business and manufacturing outside the burned district would have been impeded to a well nigh intolerable extent; and the recuperation of the people in their homes from the shock of calamity would be even harder. Every central-station man may well take pride in the record of the company and its management in its time of travail.

OPPORTUNITIES IN WINDOW LIGHTING.

Few branches of the electrical art have shown so great an improvement in the past five years as window lighting, but there is still a remarkable opportunity for raising the standards of practice in this specialized field. Close observers of window displays in different parts of the country will find much to interest them in the way of contrasts, and even a short walk down a busy retail street in a modern live town will reward the pedestrian with many diversified applications of electric service for the display of goods. So far as standards are concerned, window lighting is clearly in its infancy. Certainly no one with intelligence along advertising lines would care to see a dead level of uniformity in window-display illumination in any stated block occupied by different establishments, but when all is said and done, there is unquestionably a field here for investigation in the interests of moderate installation cost, reasonable operating expense, and especially in adaptability of equipment to the needs of different services.

Progress along sane lines depends to no small degree upon the thoroughness with which central stations and contractors attack the problem of window lighting from the engineering standpoint. Too often in the past, installations have been made without thorough study of the conditions, and apart from the evils of directly exposed lighting units with a maximum of glare defeating the very object of the display, the questions of efficient use of energy, of fixture design, of selecting suitable shades and reflectors, and above all, co-operation with expert window dressers, and accumulation of complete data of each representative installation have been neglected. Within a few feet of each other one can find the most amazing diversities in practice, and it is inconceivable that something cannot be done to standardize certain limits of design with the needs of different kinds of stores in mind, so that at least a tentative body of practice may be created which will serve as a guide to the lighting solicitor and a model to the uncertain retailer. The problem of lighting a drug-store window, for example, should be the same in Portland, Me., as in Portland, Ore., given window space of approximately equal size. The boot and shoe display of a Cleveland department store ought to be as easily illuminated with a stated number, size and disposition of lamps as a similar layout in Spokane. In brief, the same sort of work can be done to advantage in the window-lighting field that is now being conducted in the field of motor service, viz., the wider accumulation of data and its interchange through publication and other channels regarding the technical requirements of actual installations. Lighting of store windows has been made an intensely local problem, but it is time to get away from the purely local viewpoint, in the interests of cultivating better taste in display illumination—which, in itself, means more business from discriminating buyers—of helping the customer to get as much illumination as possible for a given outlay, and as a probable simplification of equipment, which means reduced costs of installation.

Only brief mention can be made of the directions along which window lighting may profitably be studied in the near future. The exposed, bare filament appears to have been finally condemned, although continually appearing in practice. More attention is going to be paid to diffusion, and with this will come a more general consideration of getting rid of undesirable dark corners in displays by concentrated beams of reflected light. The under sides of window exhibits are being treated with greater care than formerly, and the limitations of overhead lighting are being studied with reference to the clear-cut exhibition of materials and goods in the window base. Tubular sign lamps are coming into general application in place of hastily printed or stenciled cardboard legends. The psychological effect of color screens, and the possibilities of high-powered lamps spaced evenly behind heavy diffusing glassware are as yet but little appreciated. With the advent of the gas-filled lamp into the field of window lighting have come problems of ventilation and protection of material against heat; but the results have been most encouraging. The importance of providing for a certain amount of flexibility in the lighting equipment so as to permit changing the amount of light and its direction to suit different displays is not generally appreciated.

Little has been done as yet in many places along the line of displaying modern fixture types singly in windows with dignity and effectiveness. Here, surely, is an opportunity for the window dresser which permits a great variety of exhibits, shown, not in a jumble of distracting crockery, but in simple and individual displays which command attention from the class of purchasers whose interest is so desirable. Within the next two or three years it is safe to say that a new school of window display lighting will have come to the front, one combining the superior engineering treatment of lighting problems with full appreciation of their artistic side.

THE BOOSTING SPIRIT IN ENGLAND.

This year's annual convention of the Incorporated Municipal Electrical Association afforded striking evidence of the boosting spirit that has now taken possession of English central-station engineers and managers. The cultivation of the heating and cooking load, the facilitating of vehicle-battery charging, the simplification and standardization of more equitable systems of tariffs for electricity sold to the domestic consumer, and the commercial development of electrical undertakings of moderate size—these were the live subjects of the whole of the Birmingham meetings.

The operations of the Electric Vehicle Committee, during the year that has elapsed since its appointment, have been referred to in these pages as they have progressed, and these efforts culminated in the finest display of electric vehicles yet given in England under its auspices. It is true that the total vehicles on parade reached the modest number of eleven, but to those who are anxious for the popularization of this class of electric manufacturing and charging business, it meant a great deal. To English eyes it was a businesslike demonstration suitable to impress satisfactorily the minds of the 500 central-station men who were present, as well as those of the general public who witnessed the parade along the thoroughfares. To the electrical man with a memory of early attempts and early failures, it was heartening, engendering a confident feeling that this time actual success was near at hand. The vehicles included passenger roadsters, light delivery vans, merchandise trucks, battery hospital ambulance, heavy delivery wagon, etc.

The success of the Electric Vehicle Committee, devoting itself definitely to the pushing of a particular section of the business in which members of the Association are engaged, led to two other propositions for sectional committees. One was a suggestion for a committee to watch over cooking and heating affairs; and the other was for some body or other to attend to the neglected publicity and advertising department of electric supply in England.

But perhaps the most interesting function of a boosting character was a late-evening discussion and supper organized by the very progressive spirits of the Point Five Association. To this assembly Mr. Allen, of Wolverhampton, delivered an address reviewing the work of the club, discussing briefly the objects with which it was originally formed—the encouragement and development of the use of electricity for all possible domestic purposes—what it had accomplished and what it hoped to do in the future. Already, he said, the results of individual members were allowing them to see more clearly "a picture of the time when all domestic operations of heating, cooking, lighting, etc., will be carried out electrically, and to see that picture not as a dream, but as an awakening reality!" On the point of standardization of cooking apparatus, which has been often discussed by members of the club, Mr. Allen considered that it was not justifiable to relax efforts to bring standardization about just because they had not arrived at a stage when any important standard could be set up. Standardization must eventually cheapen the cost of the apparatus, bring on a larger number of consumers in consequence, and so benefit the central station. The proposition for setting up a central bureau to test and report upon cooking, heating and other domestic apparatus did not commend itself to Mr. Allen, his idea being that the Association, through the activities of its individual members who were handling such a large proportion of apparatus, formed the strongest bureau which could possibly be established.

The greatest obstacle that stood in the way of heating and cooking progress in England was held to be the legislative provisions which prevented the central station from renting out the necessary apparatus. In Wolverhampton, his own town, he was privileged to have the necessary authority, and such means, operating in combination with a point-five (or one cent per kilowatt-hour) tariff, had during six months tripled the number of private residence installations. Information collected from fellow-members of the Point Fives showed that since one-cent rates had been brought into vogue connections for about 10,000 kilowatts had been made, and that about 7,000 kilowatts of cooking and heating apparatus had been connected up in private houses. The majority of this load would never have been connected but for the ability of the consumer to rent his apparatus.

THE ANNUAL CONVENTION OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

This year's convention of the American Institute of Electrical Engineers was marked by the small number of papers presented, as compared with previous conventions. In 1912 there were 55 papers presented; in 1913, 22; while this year there were but 13 papers and one committee report. As these papers were distributed throughout a large field, eight of the technical committees being involved, there was no lack of material and the discussions were in every case sufficient to make up a normal session. Indeed, in some instances the discussion might have been carried on still longer if there had been the encouragement of additional time to be filled. The new policy, therefore, may be regarded as a success.

A notable session of the convention was that at which the Edison medal was presented to Dr. Charles F. Brush, whose early work in the development of electric lighting richly deserved this formal recognition from the Institute. His name is thus linked with those of the other pioneers, Thomson, Sprague and Westinghouse, who have already been recipients of the same honor. The personal familiarity of President Mailloux with the early history of the subject added greatly to the interest of his presentation address. This was delivered in Dr. Mailloux's usual flowing and reminiscent style and kept the attention of his audience for an hour.

Princeton Meeting of the Society for the Promotion of Engineering Education.

The twenty-second annual meeting of the Society for the Promotion of Engineering Education was held at Princeton, N. J., June 23 to 26. The papers covered a wide range of subjects but the central idea brought out was that emphasis should be laid upon fundamental principles, and that education is not so much a matter of administration as of purpose and spirit. The meeting was notable from the attendance of official representatives of a large number of educational institutions. Institutional membership is a new feature of the society organization inaugurated during the past year. Its purpose is to make the findings of the Society more immediately applicable to the educational life of the country. The institutional delegates were very enthusiastic in regard to the possibilities of this new feature of the Society activity.

The following officers were elected: president, Anson Marston, Ames, Iowa; vice-presidents, Henry H. Norris, New York City, and C. Russ Richards, Urbana, Ill.; secretary, F. L. Bishop, Pittsburgh, Pa.; treasurer, William O. Wiley, New York City; members of the council, R. H. Fernald, Philadelphia, Pa.; A. H. Fuller, Seattle, Wash.; A. N. Greene, Jr., Troy, N. Y.; E. V. Huntington, Cambridge, Mass.; Vladimir Karapetoff, Ithaca, N. Y.; D. C. Miller, Cleveland, O., and W. M. Riggs, Clemson College, S. C.

The reports of the various officers showed that the society is in a flourishing condition, the individual membership now being nearly 1,400 and the institutional membership about 50. The council recommended that the 1915 meeting be held in the Middle West.

Empire State Gas and Electric Association.

The last of the midyear meetings of the Empire State Gas and Electric Association was held at the Fort William Henry Hotel, Lake George, N. Y., on June 19. There were about thirty companies represented.

The morning session was devoted almost entirely to the discussion of advertising, with particular reference to advertising in newspapers. Through the courtesy of the Bausch & Lomb Optical Company the necessary apparatus had been provided so that a large number of the smaller newspaper advertisements could be shown on the screen. A number of very interesting methods were brought out and there was much constructive and valuable criticism.

A brief paper by Mr. Mac Sweeney, of the Rochester Railway & Light Company, was read in reference to the advertising done by this company through the newspapers and Mr. Church, of the Empire Gas & Electric Company, read an account of the special gas week which had been held in one or two of the communities supplied by his company. In quite a number of instances members had been able to trace the sale of apparatus direct to their newspaper advertising and Robert E. Livingston, of the Consolidated Gas Company, presented some interesting figures in this connection.

After luncheon the meeting reconvened and a motion was carried to appoint a committee of commercial men to devise ways and means of circulating among the members the different methods of advertising in use.

The afternoon session was devoted to the question of the supply or renewal of incandescent electric lamps or the sale of lamps or other apparatus for less than cost. Considerable difference of opinion on this matter developed and it was therefore decided to postpone further discussion of it until some future meeting when it will be made the main subject and when the various members will have had more time to prepare their arguments.

Exposition of Electrical Appliances in Frankfort, Germany.

From August 15 to September 6, 1914, an exposition of electrical appliances will be held in Frankfort-on-the-Main. The object is to furnish a vivid picture of the many applications of electricity to the needs of practical life. While most of the exhibits will be German, some will be made by other countries.

The exhibits include:

(1) Electricity in the residence and for domestic purposes, such as for light, heat and cooking; for bathrooms, toilet rooms; for ventilation, removing of dust; for the operation of small motors in connection with washing machines, pumps, cooling appliances, ironing; and for telephone and signal purposes, etc.

(2) Electricity for power purposes in small workshops and factories, as in metal and woodworking, in butcher shops, bakeries, printing establishments, welding, soldering, for chemical purposes, etc.

(3) Electricity in photography, photographic printing, etc.

(4) Electricity in hygiene, medicine and surgery, including the use of electricity in dentistry, in Röntgen-ray investigating, for galvanic and electric baths, etc.

Special stress is to be placed on having electrical apparatus in actual use. Lectures will be given on the use to which electricity may be applied. These lectures will in some cases be illustrated by motion-picture films or stereopticon views.

Safety Exposition.

The second International Safety Exposition will be held at Grand Central Palace, in New York City, December 12 to 19, under the direction of the American Museum of Safety. The purpose of the Exposition is to show how the health and safety of the worker is being looked after in the various American industries, as well as the methods which have been adopted for the welfare and education of employees. A large number of interesting and instructive government and foreign exhibits will have place. The scope of the Exposition will be limitless, embracing everything devoted to health, sanitation, safety, accident prevention, education, welfare, and the advancement of the science of industry. It is an excellent opportunity for the large industries and for manufacturers to educate the public in what they are doing to conserve and improve the lives that are dependent upon them. Following the international practice, which was adopted at last year's Safety Exposition, there will be five grades of award for exhibitors in every branch of industry.

Prosperous Japanese Central-Station Company.

A newspaper in Kobe, Japan, states that the Anglo-Japanese Hydroelectric Company seems to be so successful that it has decided to increase its capital to $1,500,000. When it started the capacity was to supply current for not more than 20,000 lights and motors of 700 horsepower. Business, however, has steadily increased, and the field supplied by the company has extended over the whole of Totomi Province, with the Hamamatsu as the center. The first generating station at Ushikubi, on the Oi River, proved insufficient to meet the demand for current, and last year a second generating station, capable of supplying current for 42,000 lights and 1,870 horsepower, was constructed on the Tomoye River.

Electric Vehicle Association Convention.

One of the interesting features of the fifth annual convention of the Electric Vehicle Association, to be held in Philadelphia, Monday, Tuesday and Wednesday, October 19, 20 and 21, will be an exhibit of electric vehicles, batteries and accessories which will form a special section of the Philadelphia Electrical show, to be held October 19-24. It is expected that the electric-vehicle exhibit will be the most comprehensive, interesting and instructive that the public has ever seen. Further particulars will be given upon application to the executive secretary of the Electric Vehicle Association, 29 West Thirty-ninth Street, New York City.

Harold Pender.

Dr. Harold Pender, director of the Research Division of the Electrical Engineering Department, and professor of electrical engineering at the Massachusetts Institute of Technology, has been called to Pennsylvania and will assume the position of professor in charge of the department of Electrical Engineering at the University of Pennsylvania.

Harold Pender was born at Tarboro, N. C., on January 13, 1879. He received his primary education in the public schools of Baltimore, Md., at McDonogh School at McDonogh, Md., preparing for college at the latter institution. He entered Johns Hopkins University in 1895, and received the degree of Bachelor of Arts in 1898, and the degree of Doctor of Philosophy in 1901. From 1899 to 1901 he was assistant in the physical laboratory of Johns Hopkins. He was instructor at McDonogh School in 1901 and 1902, and in 1902 and 1903 was instructor in physics at Syracuse University.

In January, 1903, he went to La Sorbonne, Paris, at the special invitation of Professor H. Poincare, under grant from the Carnegie Institute, to repeat there certain experiments on the magnetic effect of a moving electrostatic charge. The results of experiments extending over the entire two years preceding, confirming Maxwell's theory and an earlier experiment by Henry A. Rowland and showing that a moving charge produces a magnetic field, had been questioned by a French scientist, V. Cremieu, who had been unable to detect such an effect, although using apparatus similar to, and apparently equally as sensitive as, that employed by Pender. The experimental work carried out by Pender in Paris in conjunction with V. Cremieu, resulted in the discovery of the defect in the latter's apparatus, and proved beyond any reasonable doubt that a moving charge does produce a magnetic field, a postulate absolutely fundamental to the modern theory of electricity.

Harold Pender,
Professor of Electrical Engineering, University of Pennsylvania.

In May, 1903, he entered the apprenticeship course of the Westinghouse Electric & Manufacturing Company, was appointed to a regular position on the engineering staff of that company in the fall of 1903, and was placed in charge of the testing of sheet steel for electrical purposes. In 1904 and 1905 he was employed in the electrical engineering department of the New York Central & Hudson River Railroad, his work consisting chiefly in drawing up plans and specifications for various parts of the distribution system for the New York terminal electrification.

He was assistant to Dr. Cary T. Hutchinson from 1905 to 1909, and secretary of the McCall Ferry Power Company during the same period, and assistant to the chief engineer, Dr. Hutchinson, from 1907 to 1909.

During these four years he was also engaged upon many important engineering problems, including a report to the International Railway Company, of Buffalo, on the use of water power and storage batteries in connection with the steam plant; a report to the City of New York on the cost of supplying all public lighting from a complete lighting plant to be owned by the city; an experimental investigation of the changes produced in the electrical and magnetic properties of silicon-steel by various methods of heat treatment; the electrification of the Cascade tunnel of the Great Northern Railway; various electrical, hydraulic and economic problems in connection with the construction of the power plant of the McCall Ferry Power Company.

From 1909 to 1912, Dr. Pender was professor of theoretical and applied electricity at the Massachusetts Institute of Technology. During part of 1912 and part of 1913 he was professor of electrical engineering at Massachusetts Tech, and upon the establishment of the Research Division of the Electrical Engineering Department he was made director. He will assume his duties as professor in charge of the department of electrical engineering at the University of Pennsylvania late in 1914 or early in the new year.

Dr. Pender is the author of "Principles of Electrical Engineering," was editor-in-chief of the American Electrical Engineers Hand Book, and also of a wide range of articles and papers before the engineering societies and published in the leading technical magazines in this country and abroad.

Postal Men Have Outing.

Clarence H. Mackay, president of the Postal Telegraph-Cable Company entertained as guests 550 employees at the seventh annual outing of the Branch Managers' Association of that company at Witzel's College Point Grove, Long Island, N. Y., on June 27. The party went to the grounds from New York by the steamboat *Montauk*, chartered for the occasion.

The usual athletic events took place and prizes were awarded. Dinner was served at 6:30 p. m. after which the guest of honor, C. F. Leonard, delivered an address on organization.

Power Development in Riga.

A complete survey of the Riga district in Russia was recently made for material on which to base an estimate of the horsepower surrounding communities would take if hydroelectric stations should be built along the proposed Riga-Kherson Canal.

It was found that there were 477 industrial establishments in Riga in which motive power of some sort was used. The total horsepower produced was shown to be 87,563. The Riga electric power station also produces 7,880 horsepower for lighting, the electric railway station 2,800 horsepower, and the Riga-Orel Railway, 284 horsepower. The grand total is 98,527 horsepower.

Jovian Activities at Louisville.

Plans for future activities of the Jovian League of Louisville, Ky., will be considered at an executive meeting to be called soon. The outing of the League will be held on July 14 at Senning Park and will consist of a dinner-dance on the cabaret order. The wives and sweethearts of the members will participate in the outing.

Annual Meeting of the National Electrical Credit Association.

The fifteenth annual meeting of the National Electrical Credit Association was held at Hotel Statler, Buffalo, N. Y., on June 27. Representatives were present from the New England Electrical Credit Association, the New York Electrical Credit Association, the Electrical Credit Association of Philadelphia, the Electrical Credit Association of Chicago and the Electrical Credit Association of the Pacific Coast. President Charles M. Wilkins of Partrick, Carter & Wilkins, Philadelphia, Pa., presided.

The total membership of the five local associations comprising the National Association, as of June 1, 1914, was five hundred electrical manufacturers and jobbers, and those engaged in allied and kindred lines covering the entire country.

Secretary Frederick P. Vose's summary showed that there were 15,723 names reported during the year to the five allied associations in the aggregate amount of $1,218,624.20; that the Association generally showed a marked increase in activity in the use of the service, with a larger average of benefit accruing to each member than at any time in the history of the organization.

The treasurer's report showed that the affairs of the Association had been conservatively managed, with a resulting comfortable balance in the treasury.

A number of the operative resolutions were slightly modified, not in any way, however, changing the standard method of procedure.

Telegrams of greeting were received from the Society for Electrical Development and from other friends and well wishers of the organization.

The Association endorsed the campaign of the National One-Cent Letter Postage Association. It also gave favorable consideration to the invitation of the Panama-Pacific International Exposition to hold the next annual meeting at San Francisco in June, 1915, but before definite action can be taken on the invitation it was referred back to the several local associations for their respective views.

The election of officers resulted as follows:

President, Frank M. Pierce, Manhattan Electrical Supply Company, Chicago.

Vice-president, Allan R. McDonald, Stewart-Howland Company, Boston.

Secretary-Treasurer, Frederic P. Vose, Marquette Building, Chicago.

Upon the retirement of Mr. Wilkins from the chair, which he previously occupied in 1899 and again in 1908, he was presented with a loving cup in recognition of his continuous service on the Board of Managers of the National Association from its organization, October 7, 1898, to and including the date of this annual meeting. Secretary Vose, in presenting the cup, reviewed the service of Mr. Wilkins and credited him with being not only the originator of the principle of co-operative credit protection through an interchange of ledger experiences cleared through the local organizations covering the electrical and allied industries, but also said that Mr. Wilkins was responsible for the organization of the Pacific Coast and Canadian associations, and that since the organization of the National Association he had not missed a meeting of that body.

Camping Trip of Northern White Cedar Association.

Members of the Northern White Cedar Association and several guests made a very pleasant camping trip to the wilds of northern Minnesota last month. On June 16 a special sleeper on the Great Northern Railway left Minneapolis with most of the party, which included President J. W. Benham, of Chicago, Ill.; Vice-President L. A. Page, Jr., Directors M. J. Bell and L. A. Furlong, Secretary N. E. Boucher, J. Willemeyer, H. F. Partridge, T. M. Partridge, W. C. Moss, H. S. Gilkey, P. H. Anderes, Judge W. A. Kerr, all of Minneapolis; M. H. Bissell, Escanaba, Mich.; M. Sperry, Milwaukee, Wis.; J. A. Kinney, Chicago, Ill. At Duluth, Minn., the party was joined by M. Chapman, V. V. Anderson, T. P. Bradley, Archie McIntyre, all of Duluth, and H. W. Reade, Escanaba, Mich. At Deer River, Minn., Joseph Naugle, Bemidji, Minn., Jack O'Connell, Archie and Addie McCullom, H. A. Linde and Matt Lind joined the fold.

After leaving the train a journey through the lake with arduous portage brought the party to Prohibition City, Itasca County, on the shore of Big Smith Lake, eight miles from Marcell, Minn. A camp government was set up with Judge Kerr as mayor, H. W. Reade as judge; H. S. Gilkey, prosecuting attorney; M. J. Bell, sheriff; H. A. Linde, keeper of the key; M. H. Bissell, high chief. Three days of the liveliest frontier life experienced by the hardy cedarmen then ensued. Camp life and fishing in the many lakes that abound in the vicinity under the supervision of guides Bonlow, Vanek, O'Connell and Addie McCullom engaged to jolly tourists to such an extent that a departure was reluctantly made after an outing thoroughly enjoyed by all. One evening was spent in dancing to music on the harmonica by the second cook, accompanied by Addie McCullum on a tin kitchen plate. H. A. Linde captured the chief prize with his bear dance.

Much game was seen in that rugged country, which is the scene of former logging operations; this, with the fishing, makes the locality a veritable sportsman's paradise. Percy Black, of Deer River, chef par-excellence, added to the comfort and weight of the members of the party, who are unanimously in favor of continuing Prohibition City as the annual camping ground.

Group at Camp of Northern White Cedar Association.

A business meeting of the Association was held during the trip, at which current affairs of the Association were considered and progress reports from the various committees received.

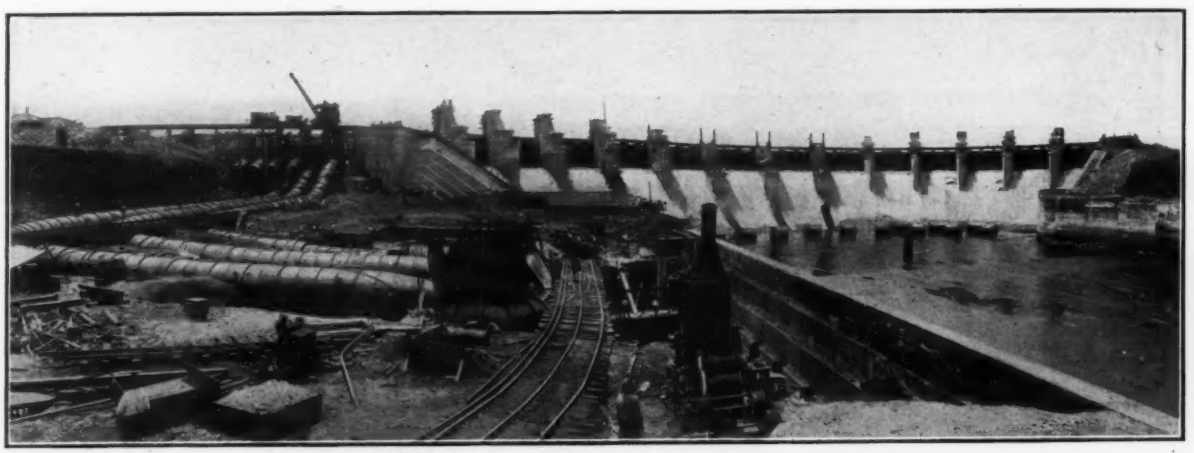
Luncheon of Sacramento Jovians.

The Jovians of Sacramento, Cal., had a very successful luncheon at the Peerless Cafe, Saturday, June 20, about twenty-five members being present and C. R. Gill presiding. A committee was named to make arrangements for holding a rejuvenation at the close of Contractors and Dealers convention, Saturday, August 8.

Gatun Hydroelectric Development.

The permanent supply of electric energy for the Panama Canal is generated in the Gatun hydroelectric station, which is located at the Gatun spillway dam. The tremendous water storage in the artificial Gatun Lake, led by the Chagres River, not only carries vessels the greater part of the way across the isthmus on a level about 85 feet above the oceans, and provides water for raising and lowering them gently through the Gatun, Pedro Miguel and Miraflores locks, but it has afforded also an excellent opportunity to generate electric current for lighting the canal, for operating the gigantic gates and other locking machinery, and for the locomotives towing ships through the locks.

Electric current will likewise be used for coal-handling plants at both ends of the canal, for machine shops, waterworks, dry docks and possibly in the future for hauling trains on the Panama Railroad. To insure continuity of service in case of accident, a steam-electric station at Miraflores, erected a few years ago to supply power for construction work, will be ready to pick up the load when necessary.



Panoramic View of Gatun Hydroelectric Development.

Brief Data on the Canal.

The extreme length of the canal is about 50 miles, it has a minimum depth of 41 feet, and the channel varies from 300 to 1,000 feet in width. The famous Culebra cut has a length of about nine miles. The crest of Gatun dam has a length of 8,000 feet and an extreme width of 2,100 feet, the height above the normal lake level being 30 feet. There are three double sets of locks at Gatun, one double set at Pedro Miguel and two double sets at Miraflores. The average lift of each set is 28.5 feet, the length of each chamber being 1,000 feet, and the width 110 feet. The time required for the passage of vessels through the locks is about three hours, and through the canal from ocean to ocean eight to ten hours.

The width of the Canal Zone is 10 miles and it has an area of 436 square miles. More than 40,000 men have been employed in building the canal and over 200,000,000 cubic yards of earth have been excavated. It is estimated that $375,000,000 will represent the total cost of this mammoth project.

Power and Distribution Equipment.

The complete equipment for the power and distribution system on the canal comprises the 7,500-kilowatt 2,200-volt Curtis turbogenerator power plant at Miraflores for emergency; a double 44,000-volt transmission line across the isthmus, connecting Cristobal and Balboa with the two power plants; four 44,000/2,200-volt substations, stepping down at Cristobal and Balboa, and up or down at Gatun and Miraflores, depending on which of the two plants is supplying power; 36 2,200/240-volt transmission stations for power, traction and light at Gatun, Pedro Miguel and Miraflores locks, three 2,200/220-110-volt transformer stations for the control boards at the locks; and stations at Cristobal and Balboa for the coal-handling plants, machine shops and dry-docks.

The Gatun Hydroelectric Station has a capacity of 6,000 kilowatts; and provision has been made to increase this to an ultimate capacity of 12,000 kilowatts, should this amount of power be required later for the operation of the Panama Railroad.

Operating Head and Intake.

The gross head available from Lake Gatun to mean tide level of the Pacific Ocean varies from a maximum of 91 feet in the extreme flood times to a minimum of 79 feet, to which level the lake may possibly drop toward the close of the dry season. The plant is designed consequently to develop its rating when operating under an effective head of 75 feet. For three or four months of every year there is absolutely no rainfall on the isthmus; and during this period it is desirable to conserve the water to as great an extent as possible. Maximum efficiency was therefore demanded for the apparatus of both the waterwheel and generator manufacturers.

Water is taken from Lake Gatun through passages 12 feet wide, fitted with wrought-iron racks 29 feet 7 inches high, to prevent trash from entering the pipe lines. The water is admitted into the pipe lines through three 10.5-foot-diameter head gates. These gates are of cast-iron construction, the seats where water tightness is required being made of bronze.

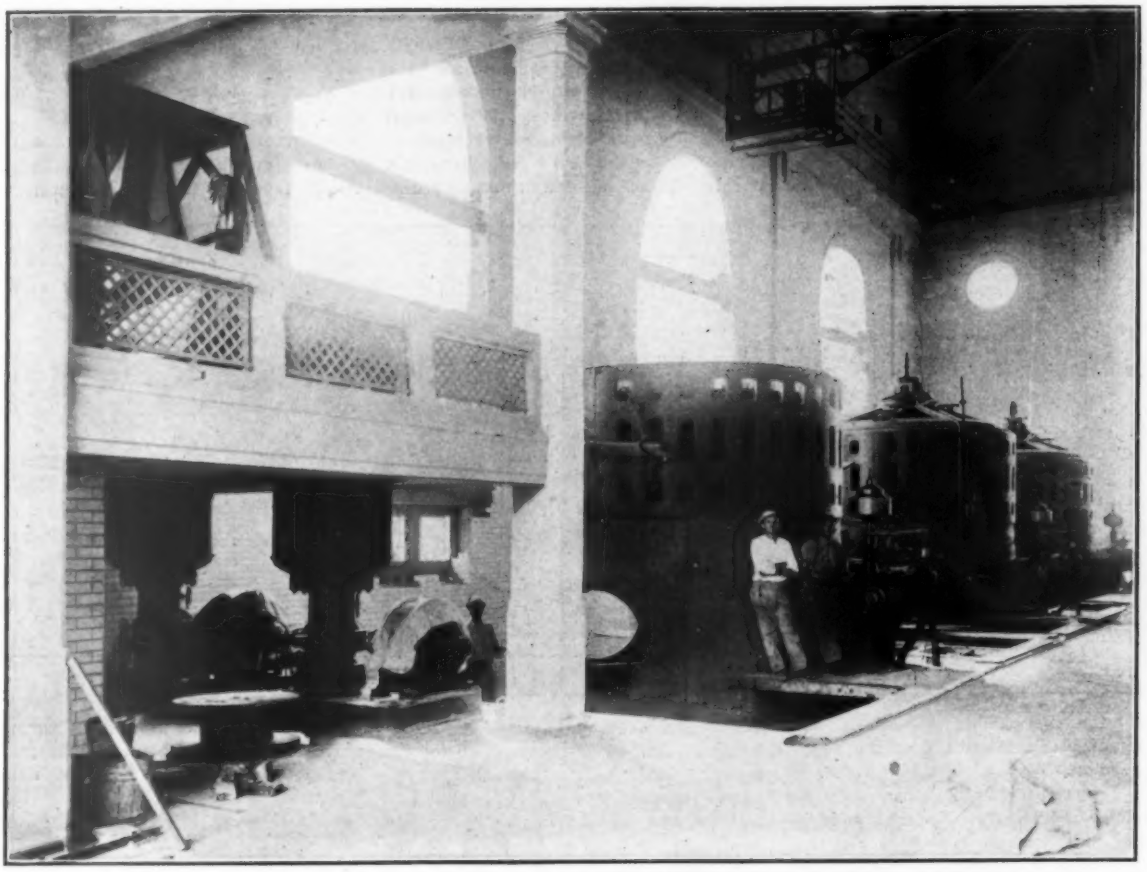
Details and Operation of the Gates.

Each gate is equipped with two steel stems for raising and lowering. These stems are fitted with bronze nuts working in roller thrust bearings, and the nuts are fitted with steel bevel gears arranged to be operated by a 15-horsepower 220-volt alternating-current motor with a speed of 750 revolutions per minute. The motor is placed between the stems and has shaft extensions on each side that carry two bevel pinions arranged to engage the bevel gears on the stem nuts. The stands which carry the stem nuts are equipped with hand operating mechanism, arranged to be disconnected when the gate is operated electrically.

The gates are equipped with automatic control devices, consisting of a

limit switch geared to one of the gate stems and a float switch actuated by the water in the pipe. The action of the control is as follows, the gate being closed and the pipe line empty: The gate-motor switch is closed at the power house, which starts the motor and begins opening the gate. When the gate has opened a sufficient distance to fill the pipe line in about five minutes, the limit switch opens the circuit and stops the motor.

The gate remains in this position until the pipe line is filled and the water rises in the 36-inch diameter air vent just below the gate, when it actuates a float switch and again closes the motor circuit, thereby causing the gate to be opened fully, when the limit switch again operates to prevent overtravel. The gate is closed by reversing the main switch at the power house, which causes the motor to operate, the limit switch again stopping the motor when the gate has reached the closed position. In case the electric power should fail, the gates can be hand operated by two men.



Interior View of Gatun Station.

The Intake Pipe Lines.

Each of these gates is bolted to a pipe line 10.5 feet in diameter with an average length of 420 feet. The pipe lines are made of three-eighths-inch steel plates in courses eight feet long, each course being made of three sheets to form the circumference. The center of each course is fitted with a three by three-eighths-inch Z-bar ring, which is also made in three sections. After the pipe was riveted together at the plant, the outside was covered with a layer of reinforced concrete to prevent rust.

The pipe lines are led down to the rear of the power house on a uniform slope from the spillway, and are connected to the turbines in the power house through 90-degree bends having a radius of 70 feet. Each of the pipe lines is arranged for attaching a Pitot-tube testing apparatus while its unit is in service, and one pair of portable tubes for taking readings in planes of the pipe at 90 degrees from each other was supplied.

This is accomplished by fitting each pipe with two six-inch saddle nozzle connections located 45 degrees on each side of the vertical center line of pipe. From these connections there are two Pitot-tube supports placed across the pipe at right angles to each other with their thin sections pointing in the direction of the flow of water, the supports being fitted with guides for the Pitot tubes. These supports are bolted in the pipes and, while they are intended to remain permanently in the pipe, if desired, they can be removed very readily.

Each six-inch outlet on the pipe is closed by a gate valve with tongued and grooved flanges that match the base on the Pitot-tube apparatus. Each Pitot tube is arranged to measure both the static head and the static plus the velocity head at practically the same point in the pipe, and readings are obtained by means of U tubes containing a colored liquid having a specific gravity of about 1.25. Carbon tetrachloride thinned with gasoline to the proper specific gravity and colored red is usually used for this purpose.

One end of each U tube is connected to the static side of the Pitot tube and the other to the side of the Pitot tube affected by both the static and velocity heads. From the difference in height of the colored liquid columns, the velocity of flow in the pipe is calculated. This form of Pitot tube is very simple and reliable, as it does not require compressed air to keep the head within readable limits and, at the same time, the difference between the static head

and the static plus the velocity head, that is, the velocity head, is read off directly.

In order to measure the flow in any pipe line, it is only necessary to bolt the Pitot-tube base plates to the valve flanges and open the gates, when the tubes can be pushed into the pipes and readings taken. When the test is completed, the Pitot tubes are withdrawn until they clear the gates; then the valves are closed, and the apparatus can be removed.

The Gatun Hydroelectric-Station Building.

The principal buildings connected with the actual operation of the canal are the hydroelectric station at Gatun spillway; the gate-control house at the spillway; the four substations of the transmission system at Gatun, Miraflores, Cristobal and Balboa; and the three lock-control houses. All these structures are designed along simple lines in harmony with the unbroken surfaces of concrete of the adjacent engineering works, and for the same reason are devoid of all modeled ornament; the plain wall surfaces are relieved only by the restrained mouldings of the bases and cornices, and architraves bounding the openings. This has the effect of enlarging the scale, or apparent size of the buildings, though they appear dwarfed by their proximity to the large masses of concrete.

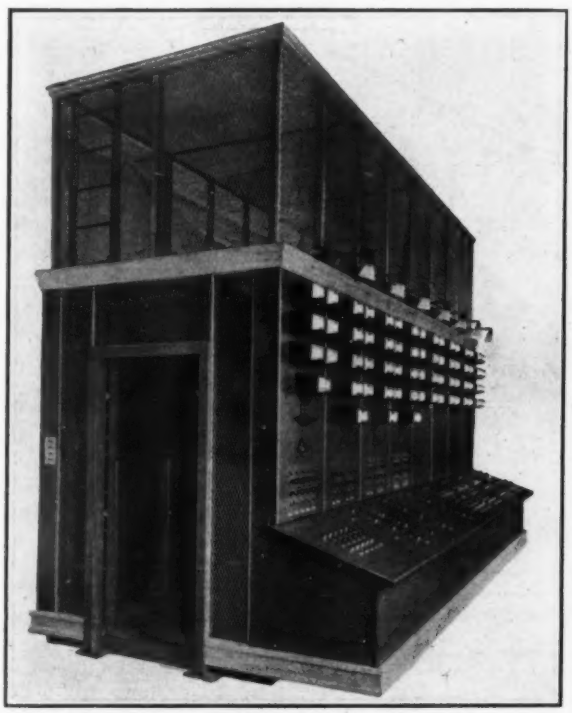
The hydroelectric station measures 61 feet by 137 feet and has an extreme height of 74 feet. The building is designed on the unit principle, to admit of future extension, and consists of a single room open to the roof, exposing the trusses upon which is laid the reinforced-concrete roof slab, which, in turn, receives the red Spanish tiles. The walls are of poured concrete, 30 inches thick to the level of the crane rails, near the cornice. The exterior overhang of the main roof is 13 feet 2 inches, and that of the monitor roof 3 feet 8 inches, the exceedingly large projections having been generally adopted for all the permanent buildings in the Canal Zone as a shelter from tropic rains, as well as from the heat of the sun.

Beyond the general use of tile for flooring, and an interior white enameled-brick wainscot 14 feet high, to relieve the coarseness of the walls, there is no difference in the finish of the concrete surfaces within and without. The dead surfaces of the concrete or stuccoed walls, which will probably be improved when weathered, are further relieved on the exterior by the red tile roofs. The principal ornamentation is on the under side of the broadly projecting cornice, which is broken up into paneled coffers. A number of these contain light outlets that cast light down on the walls and throw the structure into strong relief at night. The large glass surfaces are attractively broken up into smaller panes. Little wood is used anywhere, but for economy it is utilized in the large side frames and sash, the end frames and sash being of iron.

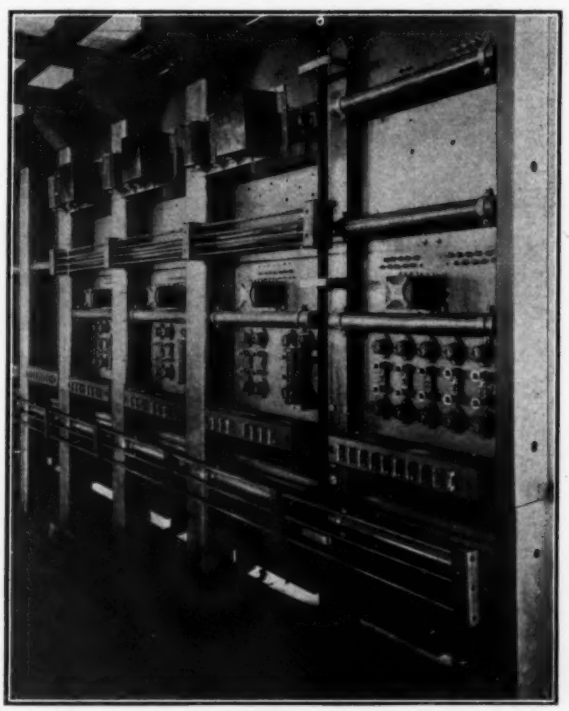
The interior has four principal elevations, namely: a pit for the three 2,500-kilowatt hydroelectric turbines, a main floor, and two galleries. The turbine pit, with an area of over 2,100 square feet, is located six feet below the level of the main floor and is reached by iron stairways descending alongside the turbines. From the pit, other stairs lead down to the storeroom on the north side, and to the air compressor and oil-pump compartments at the ends. The pit is lined with white enameled brick, which is both attractive and cleanly. The 14-foot wainscot extends from the main floor up to the first gallery elevation on the south wall of the pit.

Intermediate between the pit and the main floor, and reached by stairs from the latter, are toilets in the southeast corner of the building, giving separate accommodations for white and colored employees. The walls are treated in enameled brick, similar to the turbine pit, and the rooms are equipped with modern fixtures and separate shower compartments.

The main floor divides into two parts, one being partitioned off and devoted to the use of the electrical equipment, and the other forming an uninterrupted passage on the longitudinal axis of the building, terminating with two large entrance doors at either end. Easy access to railway cars is afforded by means of a track which enters



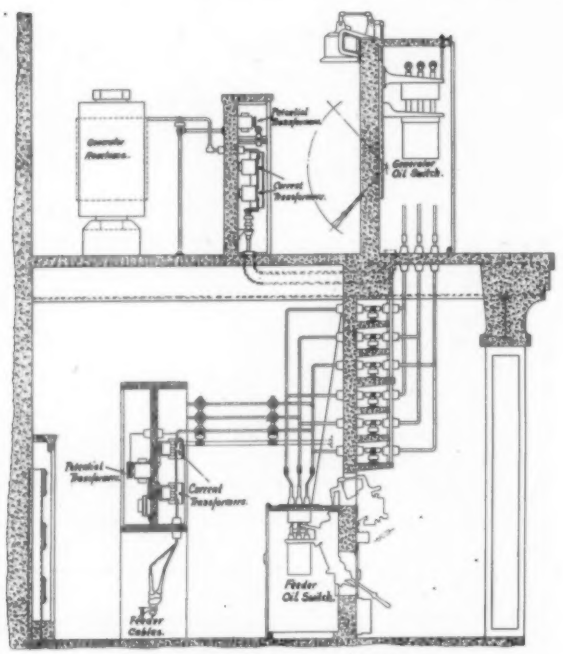
2,000-Volt Instrument and Control Board.



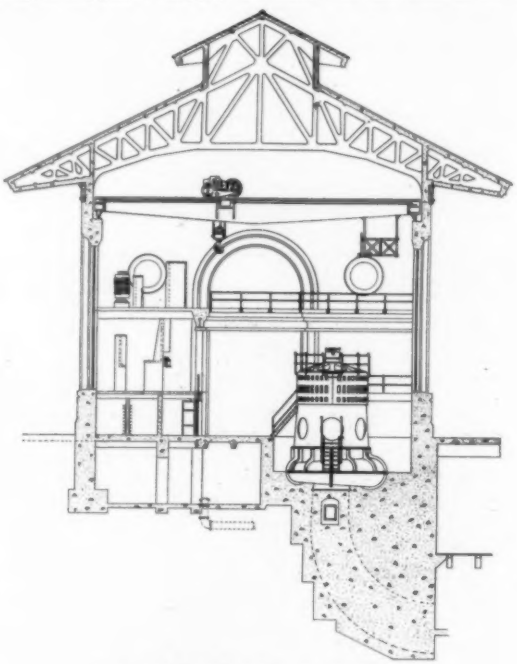
Rear View of Instrument and Control Board.

this floor from grade through the northwest door, thus giving every facility for handling heavy machinery by the 30-ton electric crane running the length of the building overhead.

Concrete stairways at either end of the building give access to the mezzanine and second galleries, which are devoted to the switchboards, oil-switch compartments, reactance coils and other electrical equipment. Two such galleries extend the entire length of the station on the northeast side, and in the south corner are superimposed two smaller ones used as a machine shop and an office, respectively. The sash in the large side wall windows are operated in sections by a hand gear system, and the continuous bottom hinged sash in the roof monitor are operated by motors.



Arrangement of Switching Apparatus.



Cross-Sectional View of Station.

The Three Francis Turbines.

The three 2,000-kilowatt main generating units in the hydroelectric station are each driven by a special, 50-inch, vertical, single-runner, Francis turbine manufactured by the Pelton Water Wheel Company. Each turbine has a maxiumm capacity of 3,600-horsepower when operating under an effective head of 75 feet and at a normal turning speed of 250 revolutions per minute. The turbines are located at such a height that the center of the runners is 20 feet above tail water.

The water is discharged through steel-lined concrete draft tubes, which are of 71 inches diameter at the discharge from the runners and increase to an elliptical section of 9 feet by 17 feet at the outlets, which are horizontal, there being a 90-degree bend in the tubes. The linings are made of one-quarter-inch steel plates, which were fitted together in the shop and shipped knocked down.

The turbines are of the spiral-case type and are fitted with heavy cast-iron distance rings which carry the generators. The weight of the revolving parts of each generator and turbine is carried on a roller thrust bearing mounted on top of the generator. The turbine is so designed that the runner exerts an upward thrust of 20,000 pounds when working at full capacity, thereby relieving the thrust bearing of that amount of load.

Oil for the thrust bearing is supplied by a small pump geared to the main turbine shaft, and a tank is provided below the pump to receive the overflow from the bearing. In this way a constant circulation of oil is maintained. As this oil returns to the suction tank, it passes through the lower guide bearing on the main shaft and lubricates it.

The runners of the turbines are made of a special bronze and weigh approximately 7,000 pounds each. They are bored taper and held in place on the lower end of the shaft by means of bronze nuts. The surfaces of the runner vanes are all hand finished to reduce hydraulic losses.

The Governors.

The speed of the turbines is controlled by Pelton oil-pressure governors, which are mounted on the distance rings and are driven by bevel gearings from the main shaft. Tachometers are mounted above the governors on supports bolted to the distance rings. The tachometers are directly connected to the governor heads.

The governors are fitted with small electric motors for varying the speed of the main units for synchronizing purposes, and a device is provided on each governor for varying the permanent drop in speed from no load to full load. This can be adjusted for any variation from five-per-cent drop to absolutely constant speed from friction load to maximum load. The governors are also fitted with hand control mechanism for adjusting the gates independent of the oil pressure.

The wicket gates for controlling the supply of water to the runner of the turbine are steel castings with hand-finished surfaces. Each gate has its pivot stem extended upward through a packing gland and is fitted with an operating lever. All the gate levers are connected to the gate ring by means of bronze links, and the gate ring is connected to the governor rock-shaft. All the regulating mechanism is therefore outside the turbine case, except the gates themselves. The water passages on each side of the gates are provided with renewable rolled-steel wearing plates.

The pressure oil for actuating the governors is supplied by two Pelton rotary pumping units, driven by 10-horsepower alternating-current motors at a speed of 375 revolutions per minute, each pump being capable of supplying the governors on all three units. The governors work on an open system, there being no vacuum chambers used. The discharge oil from the governors is led into oil sump tanks, from

which it passes into the suction of the pumps. Each oil pump is connected to a steel pressure oil receiver with an air space above the oil. The oil sump tanks and pipe connections are installed in duplicate and valves are provided to enable one set to be cleaned while the other is in service.

Generators and Direct-Connected Exciters.

The three main generating units are of the vertical revolving-field type, each being provided with a direct-connected exciter. The generators are of the General Electric Company manufacture and are three-phase, 25-cycle, with a guaranteed continuous capacity of 2,000 kilowatts at 0.8 power-factor, 2,200 volts, 250 revolutions per minute, and with an overload rating of 2,500 kilowatts at 0.8 power-factor for two hours.

The exciters are of 50 kilowatts capacity at 125 volts, each capable of furnishing exciting current for two generators under maximum guaranteed load. Each unit, generator and exciter, weighs approximately 65 tons.

The generators are carried on heavy cast-iron distance rings furnished by the Pelton Water Wheel Company, the stationary armatures being bolted to these rings. The thrust and upper guide-bearing support consists of a very rigid iron casting, bolted to the top of the stationary armature.

The thrust bearings are of the roller type, manufactured by the Standard Roller Bearing Company, Philadelphia. These bearings carry the weight of the complete revolving element, consisting of the generator field, exciter armature and turbine runner, which are mounted in this order on a one-piece shaft. The weight thus suspended is 32 tons. The exciter magnet frame is supported by lugs cast on the stationary armature of the main generator.

The exciter is readily accessible through large holes in the distance ring, a platform being provided inside the ring from which the exciter commutator and generator collector rings may be reached.

Provision is made for securing the magnet frame of the exciter to the revolving element of the generator, so that the complete rotating element, together with the exciter frame, is raised at once in disassembling.

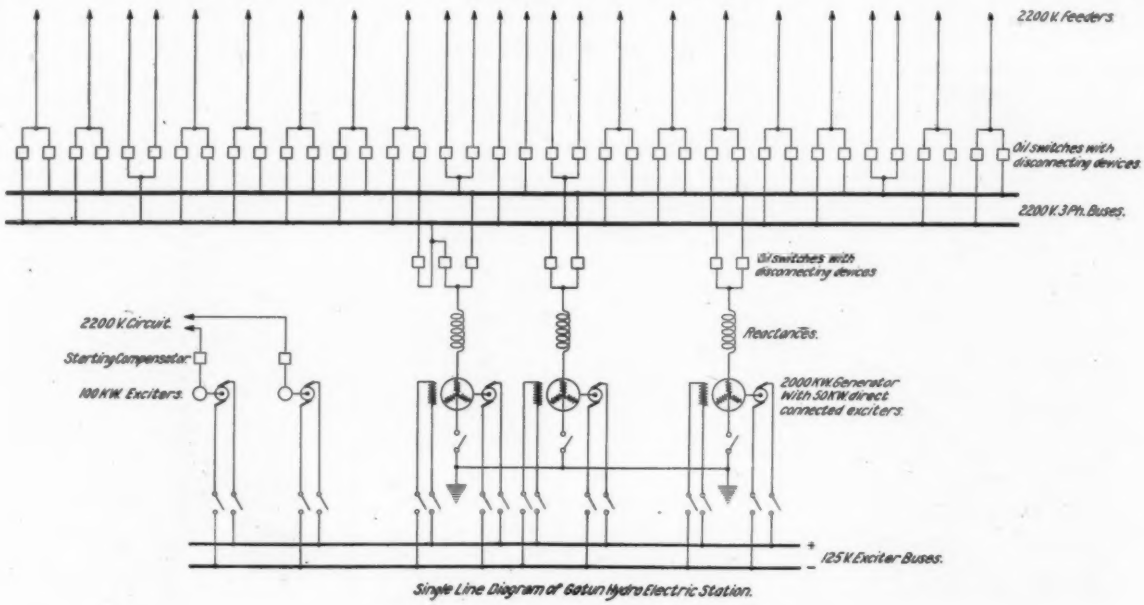
For inspection of the roller bearing it is necessary simply to remove a speed-limiting switch from the top of the shaft and the upper half of the bearing housing. There are two guide bearings, one immediately below the thrust bearing, furnished with the generator, and the other above the waterwheel, furnished by the waterwheel builder. The arrangement of the complete unit is shown clearly in the cross-sectional view.

The generators, under official tests, showed an efficiency of 95.1 per cent at 2,000 kilowatts, 0.8 power-factor; 94.3 per cent. at 1,500 kilowatts, 0.8 power-factor; and 92.5 per cent at 1,000 kilowatts, 0.8 power-factor. The guaranteed temperature rises of 40 degrees centigrade above room temperature, of 25 degrees centigrade under continuous operation at full load and 55-degrees-centigrade rise after two hours' run at 25-per-cent overload, were met with an ample margin.

All of the apparatus was subjected to the most rigid and minute inspection during manufacture by representatives of the Isthmian Canal Commission. The insulation of all windings was made moisture proof on account of the extreme climatic conditions on the isthmus. The revolving field was given a running test at twice normal speed in the testing pit at the factory provided for this special purpose.

Reactances.

Current-limiting reactances were provided to give five-per-cent reactive drop, at 2,500 kilowatts, 2,200 volts, 3 phase, 25 cycle. While the generator windings are sufficiently rigid to stand the strain of a short-circuit under full load, these reactances will reduce the shock on the windings and will also serve to render the operation of synchronizing the machines easier and safe.


2200 K Feeders.
Oil switches with disconnecting devices.
2200 K 3 Ph. Buses.
Oil switches with disconnecting devices.
2200 K Circuit.
Starting Compensator.
100 KW. Exciters.
Reactances.
2000 KW Generator with 50 KW direct connected exciters.
125 K Exciter Buses.
Single Line Diagram of Gatun Hydro Electric Station.

Single-Line Connection Diagram of Station.

Motor-Generator Sets.

In addition to the direct-connected exciters, two motor-driven exciters are supplied. These consist of a 100-kilowatt 125-volt 500-revolutions-per-minute generator, direct-connected to a 150-horsepower 2,200-volt 25-cycle squirrel-cage-type induction motor. They are mounted on a common base plate and provided with three bearings. These exciters can also be used for charging the control battery.

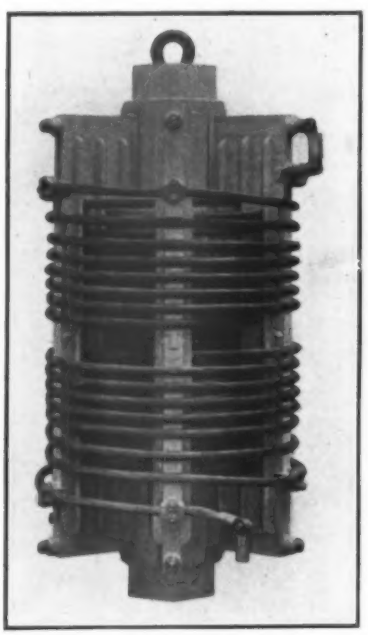
Distribution Scheme.

On account of the great distance, the current is transmitted at a voltage of 44,000 from the power stations to both ends of the canal. The step-up transformers are, however, not located in the power plants, but in substations in their vicinities; therefore, the power plants generate and distribute only 2,200-volt current.

The system of connection throughout employs the double-bus, double-switch scheme, with provision for disconnecting any oil switch for cleaning or repairs without interrupting the circuit. This system was naturally selected for this station because it was considered the most flexible for the requirement of uninterrupted service, which the engineers of the Isthmian Canal Commission have so carefully considered, though without superfluous complications.

Instrument and Control Board.

The main switchboard is of the benchboard type, with vertical rear board for relays, watthour meters, graphic instruments and the control-battery equipment. The switchboard and all control apparatus were built by the General Electric Company. The



Current-Limiting Reactance.

space between the front and the rear boards is enclosed by grille work with doors at both ends, and a metal moulding extending along the floor and the top of the board gives a finished appearance to the whole. On the top of the switchboard is a second story, for the electrically controlled generator and exciter rheostats, accessible by means of a ladder inside the structure. The first panel from the left in the benchboard controls the exciters, the next three the generators and the remaining four the 24 feeder circuits. The system of connection is represented by dummy buses of polished copper on top of the bench. The interior view of the benchboard shows the arrangement of operating buses and fuses, potential buses, instrument resistances, and the channel-iron risers with distributing tubes, which carry the instrument and control leads to their points of connection on the board.

A generator voltage regulator, transferable to either of the two sets of buses, is installed on a separate pedestal which also carries the synchronism indicators and clock.

Exciter Board.

As before mentioned, the exciters are controlled from the benchboard, but the electrically operated exciter switches and field switches are mounted on a separate board located so as to make the exciter connections as short as possible. This arrangement eliminates the exciter buses and the main connections from the control board, but leaves the control of the whole equipment in the hands of the operator.

Bus and Switch Compartments.

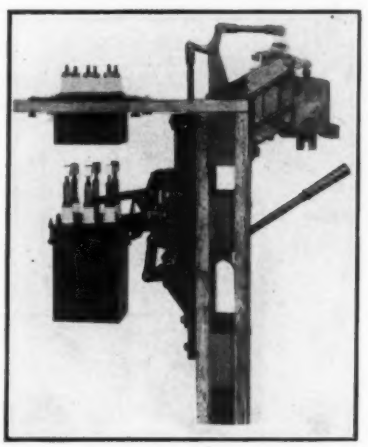
The bus and switch compartments are located on two galleries. On the upper gallery are located the control board near the end of the station that may be extended, the generator reactances, compartment for generator current and potential transformers, and the generator oil switches. From the oil switches, connections are made through the floor to the buses on the gallery below, on which gallery are also the feeder oil switches, and the compartment for the instrument transformers and cable bells. On the main floor, just below this gallery, is the cable vault with racks for the feeder cables.

All compartments are built of concrete with flame-proof doors. The buses and connections are made of solid copper rods of sufficient size to give a rigid construction even where the current is very small. After installation, the buses and connections and all joints are heavily insulated with varnished cambric to make them perfectly safe.

All the 2,200-volt oil switches are solenoid operated and are provided with mechanism for disconnecting them easily for cleaning or repairs, so arranged that the live parts are completely covered. For the hand-operated switches, a pipe framework supports vertical metal guides which carry the oil-switch operating mechanism and slate base forming a section of the switchboard panel. On the guides a lever and toggle mechanism is mounted, by which the oil switch and slate base may be raised and lowered. Above the oil switch and mounted on the pipe framework a stationary cast-iron base carries the disconnecting-switch studs and insulators. The high-tension leads run to the tops of the disconnecting-switch studs, and the bottom of each stud is equipped with contact fingers. On the top of each oil-switch stud is mounted a contact blade.

When the oil switch is raised, these blades engage the contacts on the bottom of the disconnecting-switch studs, which thus in the closed position form extensions of the oil-switch studs. The disconnecting-switch contacts are surrounded by insulating shields which prevent accidental contact. When the oil switch is lowered, it is completely isolated from the circuit. When the oil switch is raised, it always goes to a fixed height where it is latched. An interlock prevents the oil switch from being raised or lowered unless its contacts are open, precluding the circuit being closed or opened by the disconnecting switch. In some instances another interlock makes two single-throw switches a double-throw switch and prevents both switches being closed at the same time.

For solenoid-operated switches, the same form of disconnecting switch is used; but the solenoid is stationary, and the connecting mechanism to the oil switch has a vertical slotted link that allows the oil switch to be raised and lowered without being disconnected from the solenoid mechanism. A



2,500-Volt Oil Switch.

mechanical interlock prevents raising or lowering an oil switch while in the closed position.

The complete hydraulic equipment for this installation, including the racks, headgates, pipe lines, Pitot-tube testing apparatus, turbines, governors and oil-pumping units, was designed and built by the Pelton Waterwheel Company.

All the electrical apparatus required, including the generators, switchboards, transformers, head-gate motors, limit switches, float switches, accessories and motors for driving the oil pumps, was designed and built by the General Electric Company. The details of design and manufacture of all this apparatus were subject to the approval of the Isthmian Canal Commission's engineers.

Commercial Practice
Management, Rates, New Business

New Record in Louisville House-Wiring Campaign.

All records were broken last week by the solicitors of the Louisville Gas & Electric Company in its house-wiring campaign, a total of 787 contracts, representing $4,137.04, having been signed. This is the best since the campaign was inaugurated on January 1 and brings the total number of contracts to date to 1,056. The figures show a total of 1,675 new subscribers since the first of the year, which is to say that outside contractors, working independently of the company, have wired 519 houses in the six months just concluded.

The house-wiring campaign of the company has proved so successful that Robert Montgomery, manager of the commercial department of the company, on July 1 began a similar campaign to get contracts for converting the household heating systems into gas-burning plants. The contracts will call for service only. The company works through independent contractors in installing the systems.

Good Business at Minneapolis.

The Minneapolis General Electric Company during the week ended June 13 secured 206 lighting contracts, for a total of 316 kilowatts, and 17 power contracts covering 582 horsepower in motors. One of the power contracts was for 127 horsepower for the new postoffice at Minneapolis, which, it is estimated, will use 200,000 kilowatt-hours a year.

ELECTRIC DRIVE IN THE WOODWORKING SHOP.

By C. A. Stanley.

The average central-station power salesman looks at the woodworking shop in a very pessimistic attitude. Not that the business is an undesirable central-station load, but because there are generally many obstacles in the way of getting the business, such as, getting rid of shavings, etc.

The reader will not find much in this article to aid him in his difficulties with this class of business. He may, however, find just what he is looking for and will doubtless find in this data very interesting information.

The writer was very successful in the equipment for electric drive and the sale of central-station service to the J. D. Johnson Lumber Company, of Erie, Pa.

The following will show the original equipment of mill, also the figures submitted to the owner as the cost of operation by steam-engine drive.

The plant is located in the business section of Erie and is handling 75 per cent of the city's business in this particular line. The work is mostly finishing dry lumber, making doors, sashes and interior finish. The original boiler equipment comprised one Erie City water-tube boiler having 82 tubes 3 inches in diameter and 14 feet long.

The engine was manufactured by the Skinner Engine Works, Erie, Pa., and was of the simple slide-valve type with cylinders 13 by 18 inches. The engine was belted to line shaft which extended the entire length of the mill.

The load curve, Fig. 3, is shown which was made from a 10-hour, engine indicator test; indications were taken at intervals of ten minutes. The average load was 52 horsepower; the minimum load 44.6 horsepower and the maximum load 69.5 horsepower. The minimum load is the total friction load of mill and engine.

The entire amount of waste material at the plant was used for fuel in addition to the amount of coal as shown.

The following will show figures submitted to the owner as estimated cost of operation by electric drive, and later on, the actual cost as determined from several months' operation on central-station service.

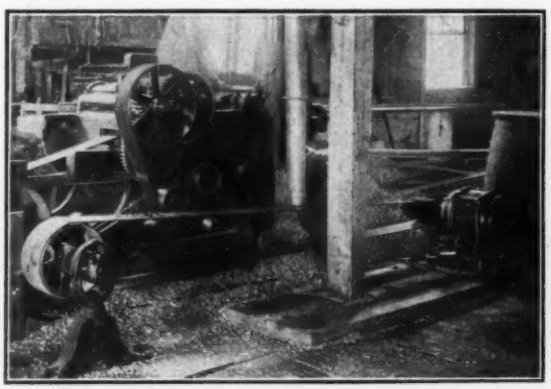


Fig. 1.—Molding Machine Driven by 10-Horsepower Motor.

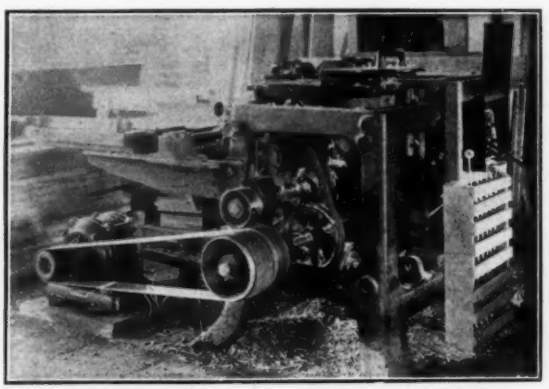


Fig. 2.—Two-Horsepower Motor Belted to Dado.

COST OF OPERATION.
Steam Drive.

	Per Year.
Coal, 0.5 Ton per day at $2.00	$ 300.00
Engineers and Fireman at $14.00 week	728.00
Water	75.00
Repairs, Boiler and Engine	50.00
Lighting (Electric)	60.00
Oil, Waste, etc.	50.00
Repairs, Main Shaft and Belt	15.00
Total	$1,278.00

COST OF OPERATION.
Electric Drive.
Estimated.

	Per Year.
Coal for dry kiln and heating	$ 150.00
Labor, Fireman (1 hour per day)	60.00
Water for Boiler	20.00
Electric Engery	615.00
Repairs, motors and wiring	20.00
Total	$ 865.00
Showing a saving of	$ 413.00
Sale of waste material	$ 250.00
Time of one man in mill	750.00
	$1,000.00

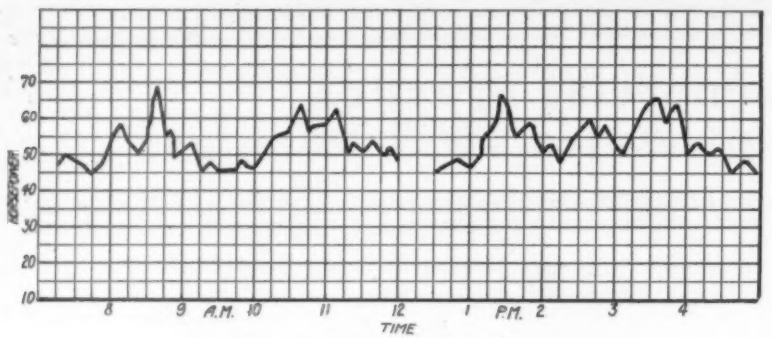


Fig. 3.—Load Curve of Engine.

It will readily be seen that with electric drive, the entire cost of power has been saved and also the customer has $135.00 over. This saving, as will be seen, is due to the increased efficiency in the operation of the mill. With the old steam drive, if two or three heavy machines were thrown on at the same time, the engine speed would drop, resulting in a low output and oftentimes an inferior product. With electric drive the speed is constant and the time required to turn out a certain amount of lumber has been reduced sufficiently to actually save the time of one man.

The kilowatt-hour consumption per month for six months' operation was as follows:

April	4,720
May	4,480
June	2,640
July	2,760
August	3,000
September	2,600

The curve in Fig. 4 shows the load, during an entire day, using electric drive. As will be seen, the heavy machines were not operated for long periods. There will be some months in the year when these heavy machines will operate almost constantly, owing to the class of lumber required at that particular time, consequently the demand, for such months, will be higher.

This plant is operated from the power lines of the local lighting company at 2,200 volts, 60 cycle, three-phase. Three 15-kilowatt transformers are located in a small building at the rear of the lumber company's office. This building is of wood construction lined with sheet iron, tile and cement, making it practically fireproof. The main switchboard is also located in this building, on which are mounted the lighting company's meters. The total cost of electrical equipment including motors, transformers, wiring, etc., was $2,950.

A local test was made with the plant using entire electric drive from which the demand load was determined.

The following shows the actual cost of operation by electric drive, figured on a yearly basis, but taken from six months' operation during which six months the plant turned out more than the normal amount of business.

COST OF OPERATION.

Actual

	Per Year.
Electric energy, light and power	$ 620.00
Coal for heating kilns	142.00
Labor, fireman	60.00
Water	18.00
Repairs	5.50
Total	$ 845.50
Showing an actual saving of	$ 432.50

In addition to this saving, the following must be considered:

	Per Year.
Sale of waste material	$ 240.00
Saving time of one man in mill	750.00
	$ 990.00
Making a total saving of	$1,422.50

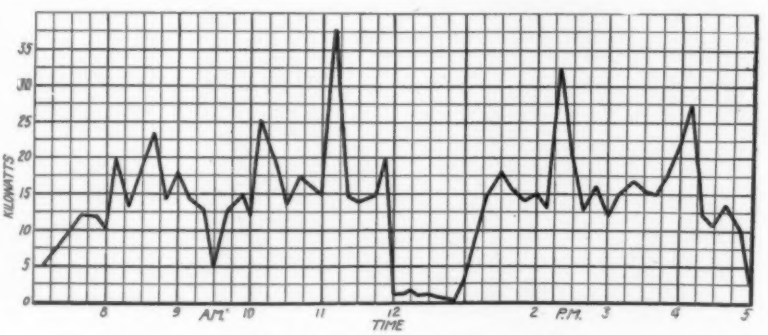


Fig. 4.—Daily Load Curve.

Machine.	Motor. H. P.	Free. H. P.	Light Work. H. P.	Heavy Work. H. P.
S. A. Wood Molder	10	5	7	11
Re Saw 20" Saw	10	2	7	12
Planer (4 Side)	25	10	14	23
Rip Saw 12" Machine Feed	7½	2	4	8
Surface Planer 24" Machine Feed	10	5	7	12
Rip Saw 10"	3	1	2½	3½
Small Jointer 10"	2	1	1½	2½
Swing Saw 10"	3	1	2	3
Blower for Waste Material	15	5	7	12
Emery Wheel 6"	½	¼	½	—
Cut Off Saw 10"	3	1½	2	3
Rip Saw 10" Light Work	2	1	1½	2¼
Boring Machine (Wood)	1	¼	½	1
Sander Invincible 42"	15	10	12	18
Surface Planer 24"	5	2	3	6
Band Saw 36"	1	½	¾	1¼
Rip Saw 8" Light Work	2	1	1½	2
Lathe (Wood)	1	½	¾	1¼
Groover Spindle Machine	3	1½	¾	1¼
Groover Spindle Machine	3	1½	2	3
Sticker	2	¾	1¼	2¼
Mortiser, Small	2	1	1¾	2¼
Tenoner	3	¾	2	2¾
Cut Off Saw (Bench)	2	1	1½	2
Surface Planer, Small	3	2	2¾	3½
Dado	2	1¼	1½	2¼
Swing Saw 16" Heavy	5	1	3	6
Rip Saw 18" Machine Feed	10	4	6	9
Air Compressor	2		1¾	

Urbana Central-Station Situation Cleared Up.

The City Council of Urbana, O., has given the Urbana Light Company a new franchise embodying rates recently required by the State Utilities Commission to which the company had appealed from the requirements of the Council. The latter had insisted on a commercial rate ranging downward from nine cents a kilowatt-hour, which was indorsed, in modified form, by the Commission, the rates being so scaled that all users of like quantities pay the same charge. The rate for street lighting will be $57.50 for arc lamps, under the new franchise, which goes into effect immediately. A number of new street lamps are to be installed, and the wires in the downtown district will be placed underground at once.

Successful Temporary Use of Cluster Lighting.

A complete system of boulevard cluster electric lights, installed for the occasion, afforded splendid illumination for the Dayton View Celebration held in Dayton, O., last week, making the lighting one of the most conspicuous features of the carnival. The lights were unusually well arranged, considering the fact that they were intended for temporary use only, and showed the possibilities of electricity in this connection.

Electric Sign Data

Slogan Signs.

Merchants everywhere realize what slogans have done for different lines of business, for instance, "There's a Reason." The mind instantly reverts to "Postum." Another voice cries, "Look for the Spear." "The Flavor Lasts." Again, automatically, there comes to your mind "Wrigley's Spearmint."

It is absolutely true that there are extremely large business houses who place their name or slogan before the public to such an extent that the advertising or names thus secured become their most valuable assets. The national advertisers of the world claim and can prove that electric sign advertising is the best for results. They have reasons, a few of which follow:

(1) Electric signs not only burn the name of the advertiser or the article he wishes advertised into the minds of the general public, but produce a modern appearance which people of today demand.

(2). They improve the lighting condition of the city, making the business streets attractive and inviting and insuring protection.

(3). Light attracts, in the same proportion as darkness repels.

(4). Broadway, New York, has become famous throughout the world. What has made it so? Electric signs.

(5). Every electric sign that is erected is a big asset not only to the merchant who erects it but to the city in which it is erected. These signs all receive a due amount of advertising through the different journals, which are numerous and are read throughout the world by men in every line of business, and the city with merchants wide awake enough to appreciate the value of electric sign lighting receives the admiration of the broadest-minded men of the world.

There are several reasons why every merchant should consider well the benefit to be derived from the latest and best method of advertising.

(1). Electric signs are the best advertising medium. Every passerby sees them and is influenced by them.

(2). The public is impressed with the fact that the merchant is progressive and modern. The gloomy, dull store front invites nobody to loiter and examine; the bright, attractive place of business draws people in spite of themselves and their possible prejudices.

(3). How often do we see in what might otherwise be a fine advertisement the direction, "Blank's Shoe Store, opposite City Hall," or "the Jail," or "the P. O. S. of A. Hall," or some other landmark in the city, advertising as well that the business is not modern enough to have an identity of its own? Electric signs denote individuality and serve as a landmark to the buying public to locate the stores whose ads have impressed them.

In respone to a contest which is being conducted by the Pittsfield (Mass.) Electric Company for a slogan which is to appear on a large electric sign the company purposes to erect, more than 400 suggestions have been sent in to the special committee appointed by the president of the Board of Trade. From the large number received, this committee has selected for the slogan of that city "Pittsfield, Heart of the Berkshires." This selection is the result of a competition for which prizes of $10 and $5, respectively, were awarded for the best suggestions. The first-prize was awarded to a public-school pupil, Marcel LeClair.

The Pittsfield Electric Company will at once erect a slogan sign bearing this inscription.

The slogan sign for Peoria, Ill., will measure 45 by 70 feet, and will read, "Peoria, the Heart of Illinois." It will show a heart-shaped panel construction twenty feet in height; the letters will be twelve feet high. The heart will light first at five feet high and expand to twenty; then the lights show a rapid chasing effect and retract again to five feet and repeat. There will be 1,800 lamps in the sign. The contract was secured by the J. P. Goebel Company.

The Denver Gas & Electric Light Company recently began an interesting campaign for the development of late-hour commercial business, the effort being to induce merchants to keep the interiors of their stores brilliantly lighted up to midnight. The unquestioned value of the interior display afforded, makes a strong talking point for the central station. And it was only a step in the merchant's mind, from the late illumination of his windows and signs to the late illumination of his interior store displays. Several Denver merchants have adopted the plan. This business is made possible by a regular patrol of the Company that switches off these lights at midnight.

The Denver Company has been very successful in this campaign.

Sign sketch contributed by the Greenwood Advertising Company, Knoxville, Tenn.

Dimensions of sign are 9.5 feet by 4 feet. Letters spelling "Hotel" are 12-inch and letters spelling "Winecott" are 18-inch raised, slant script.

There are 100 receptacles provided for five-watt lamps.

Any desired color scheme can be provided. Background is imported glass smalt.

Any flasher effect desired can be obtained.

Approximate price $135 double-face, $80 single-face.

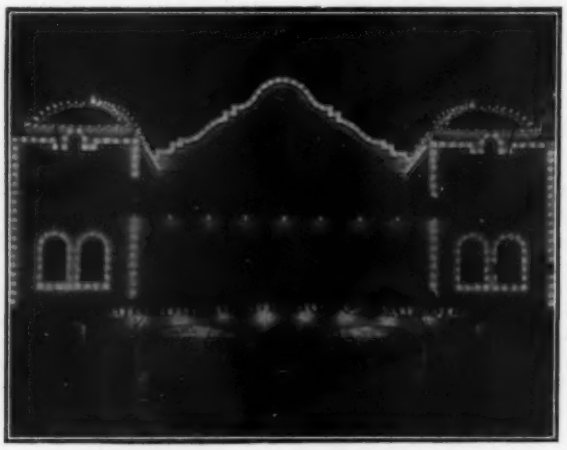
Electrical Construction

ELECTRICAL EQUIPMENT IN A MOTION-PICTURE THEATER.

By Herbert C. Moss.

The Mission Theatre, Seattle, Wash., is a motion-picture house with a design quite out of the ordinary. The exterior with its low arched doors, its red tile roof and picturesque towers closely resembles the old mission churches of the Southwest. The mission effect is also carried out in the interior. Rough stained beams on the ceiling, lattices on the sidewalls and a pergola effect near the ceiling, give a very pleasant and cozy auditorium. At the rear is a short balcony, with loges in front.

Interior View Showing Lattices.



Exterior View of Theater at Night.

The lighting is all indirect, the light coming from behind the lattices, and through a large leaded-glass ceiling. The lattices are set out from the wall about eight inches, and are supported by heavy beams or lodges and so boxed in, that illumination is obtained only through the lattice portion.

The lower lattice is two feet high, and about eight feet from the floor, at the center of the house. The upper lattice is four feet high, and about 24 feet from the floor. Conduit outlet boxes, with receptacles and lamps, are installed on the ledges, and are concealed from view by an eight-inch board, above and along which the lattice extends.

In the upper lattices, 25-watt lamps are installed, 12 inches on centers. In the lower lattices, 15-watt lamps are installed, 24 inches on centers. Clear lamps are used without any reflectors. Inside the lattice, the inclosing walls are painted a deep cream—just enough yellow to give the light a warm and restful color. Behind the lattices, the distribution is good, and the space seems quite filled with light.

The lower lattice is vine clad,—this breaks the monotony of an unadorned lattice, and gives a very pleasing effect.

In the center of the ceiling, a leaded-glass skylight of three panels covers a space 34x24 ft. In the center of the skylight, a space eight feet square is latticed, and reserved for an echo organ, which is inclosed and installed behind the lattice. The distance between the ceiling and the roof is seven feet. There is no opening in the roof, and no daylight comes through. The ceiling is of amber glass, leaded in small squares with a green border. Six 750-watt gas-filled lamps are used to light this glass.

At each outlet, a special steel-cone reflector, four feet in diameter, built at an angle of 20 degrees from the horizontal, is hung directly against the roof, as far above the glass as possible. A 750-watt lamp is suspended under each reflector, and a heavy opal-glass bell, similar to those used on the old General-Electric diffusing arc lamp is inverted under the lamp. This bell throws the light on the enameled surface of the reflector, and prevents the light source being seen through the leaded glass from below.

This is probably one of the first installations where the new gas-filled lamp is used to light a skylight. The results obtained were even better than were hoped for. The light shining through the leaded glass, so closely approaches a daylight diffusion in intensity that several electrical men who saw the installation in the daytime, asked what means were provided for closing the shutters on the skylight.

The lighting of the skylight, and the upper lattice is controlled by means of a "Diamond H" solenoid switch, with remote-control push buttons in the operator's booth, and in the foyer of the ground floor. These lights are used only a short time each performance.

The lower lattice is kept burning continuously, and provides enough light for patrons to seat themselves, even when coming in from the bright sunlight outside. This in itself is an advertising feature of no small value. The light is so well diffused, and its intrinsic brightness so low, that it does not affect the picture on the screen.

Outline lighting is used on the exterior; 25-watt lamps being spaced 12 inches on center. While these lamps are much larger than would ordinarily be used, exceptional brilliancy is required, as no sign is used, and the brightness of the lighting is the sole method of advertising the location of

the theater. Twenty-four, 100-watt round-bulb frosted lamps are distributed under the marquise.

In the entrance, are four 750-watt gas-filled lamps, inclosed in especially handsome Lucidia balls.

The operator's booth is equipped with two Simplex picture machines, a two-arc dissolver, or stereopticon, and a spotlight machine. The rheostats for the machines are in the attic above the booth. For each of the Simplex machines, there are three single-pole knife switches, each of which cuts out a certain portion of the resistance in the rheostats. This was installed so that if the voltage fluctuates, or it is necessary to have a stronger current for colored films, added voltage can be had at an instant's notice.

Interior of Operating Booth.

In front of the screen, a heavy velvet curtain slides both ways from the center on a track above. This curtain is operated by a motor under the stage. Three-eighths inch extra flexible steel cables extend between the curtain and the motor, and operate over six-inch ball-bearing hooded sheaves. Connected to the motor by means of a worm gear, is a drum for the winding of the cables. Limit switches, which automatically stop the motor when the desired limit of travel has been reached, are attached to the motor base. A slate panel, on which are mounted solenoid switches and necessary contacts, is mounted on the wall beside the motor. This panel, about two feet square, and a slate base of about the same size on which are mounted the motor, drum, etc., are the only two pieces of mechanism. No counterweights are required. It is an especially compact and efficient apparatus. Remote-control push-button switches in the operator's booth and in the orchestra pit, operate the curtain motor through the solenoids. This curtain control was designed and installed by W. M. Price of Seattle, Wash.

An intercommunicating telephone system is installed, with stations in the operator's booth, manager's office, ticket office, orchestra pit, and dressing room.

Direct-current service at 115-230 volts is obtained from the Puget Sound Traction, Light & Power Company. Motors for heating and ventilating fans, organ bellows and vacuum cleaner are operated on 230 volts direct current.

A main service and an emergency service are run to a power line in an alley. The service wires are connected together outside, however, as all current is obtained from the same Power Company.

In a distribution cabinet adjacent to the foyer there is a double-throw switch, controlling the lights in the lower lattice, foyer, stair, and exit lights. This switch is fed from both the main service and from the emergency service.

The electrical equipment was installed by Ne Page, McKenny & Company, Seattle.

California Contractors and Dealers to Meet at Sacramento.

The fifth annual convention of the California Association of Electrical Contractors and Dealers will be held in Sacramento August 4-8. Co-operation will be the watchword and it is hoped there will be a large attendance from all over the state, as this occasion will offer a fine opportunity to get together and exchange ideas.

In addition to the regular business meetings, there will be two open sessions at which special papers will be read by well-known men in the electrical field, the papers being of such nature as to be of great interest and value to all.

For entertainment during the convention, the committee in charge has provided numerous features which will cover the entire period. Among these are boat rides down the river, auto trips, baseball and other amusements. There will also be plenty of entertainment for the ladies separately. Headquarters will be at the Hotel Sacramento.

The present officers are: C. V. Schneider, of Sacramento, president; C. Loveday, of Santa Barbara, first vice-president; G. Sitman, of San Francisco, second vice-president; W. S. Hanbridge, secretary-treasurer; and F. Somers, sergeant-at-arms.

The city of Vienna, capital of Austria-Hungary, is planning to build an electric-traction subway system at a cost of about $30,000.

A Peculiar Case of Motor Trouble.

While acting as troubleman on complaints for a large electrical manufacturer, I was one day sent to a factory where they were using about 150 of the company's motors. The complaint was on a three-horsepower 220-volt direct-current shunt-wound interpole motor, and it stated that the motor ran satisfactorily until the belt was tightened, when the motor ran away. The belt connecting the motor to line shafting was very slack and apparently slipping badly, as it was squeaking loud enough to be heard all over the floor on which the motor was located.

The company's electrician informed me that he had tightened the belt the day before and as he did so the motor speeded up and blew its fuses. He stated that the motor had been installed about a year and that he had noticed the belt slipping the first morning he came on the job. He started to put some belt compound on belt when the foreman in charge of the floor told him that the motor would run away if he did so. He thought it best not to take any chances the first day, but resolved to look into the mystery at a later date. This was put off from time to time until about three months had elapsed, when I was called in to remedy the trouble.

As I laughed and did not seem to put much faith in the electrician's story, he stepped up to the belt and held a stick of belt compound on it. Immediately the speed of the belt increased to an alarming degree. I shut the motor down, looked over all connections and nothing seemed to be wrong with the exception of commutator and armature, which were very hot. The compound was cleaned off the belt and the motor started again. Everything seemed to be working satisfactorily except that the squeak in the belt showed that the belt was still slipping.

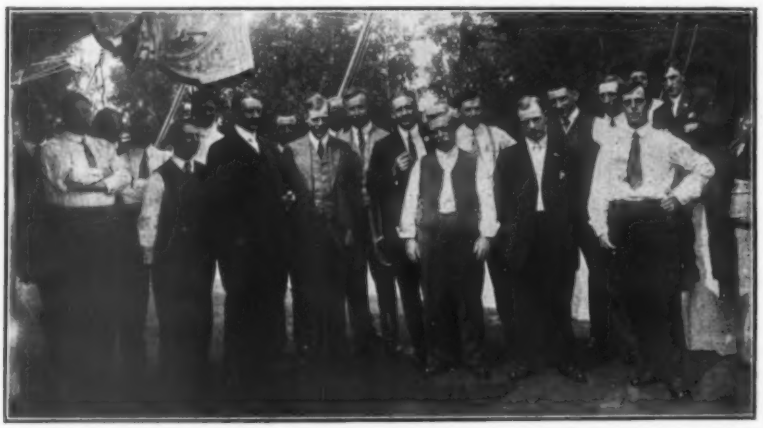
Finding that the speed of the countershafting was correct, I next tested the speed of the motor and found that instead of running at its rated speed of 1,200 revolutions per minute, it was running at 1,780 revolutions per minute. I looked for signs of a weakened field, found no such evidence, and then examined the brushes. These I found to be set back about three-fourths of an inch from the marked neutral, thus causing the motor, which was of the interpole motor, to run at excessive speed. The slip in the belt had been just enough to allow the countershafting to run at its required speed, but the moment the belt stopped slipping the impression from the noise due to the high speed of the shafting was that the motor was running away.—H. W. Parsons.

Annual Meeting of Minnesota Electrical Contractors' Association.

The annual meeting of the Minnesota Electrical Contractors' Association was held at St. Paul on June 22. The members met at the Builders' Exchange in that city and were conveyed in automobiles to the new Automobile Club House at White Bear Lake, 12 miles out of the city, where they were the guests of the St. Paul delegation. The business session was called to order at 11 a. m., with 18 members represented.

The following new members were elected: Northern Electric Company, Minneapolis; Hubbard Electric Company, St. Paul; Blake Electric Company, Hibbing; Home Electric & Construction Company, Hibbing; Foster Electric Company, Rochester. A general discussion of Association matters ensued.

At 1 p. m. a chicken dinner was served and the afternoon session was called to order at 2:30 o'clock. Committee reports were then presented and there was considerable discussion regarding the activity of the labor union in getting amendments through the Legislature relative to state licenses and control of the State Board of Electrical Examiners.



Group of Minnesota Contractors.

The election of officers resulted as follows:

President, A. L. Abbott, St. Paul.

First vice-president, T. Findley, Minneapolis.

Second vice-president, J. W. Nelson, St. Paul.

Secretary, G. M. Jones, Minneapolis.

Treasurer, C. T. Nimis, St. Paul.

Director of the National Association, A. W. Zahm, Minneapolis.

Mr. Eder, secretary of the Minneapolis local association, read a paper which had been prepared by George W. Hill, representative of the National Electrical Contractors' Association, setting forth some facts regarding the work and progress of the Association and what it is accomplishing for the membership. He called attention to the fact that greater co-operation is being secured with the central stations and that some effort on the part of the contractors in this direction will generally bring excellent results. In many instances the central stations are co-operating with the contractors in the soliciting of new business and through this the contractors are getting additional business and profits.

A. L. Abbott then presented a paper entitled "Costs, Estimating and Contracting as a Business." He submitted two sample forms for an estimate schedule and estimate sheet and there was considerable discussion on the subject of profits and their relation to costs.

Walter Vilett then presented a paper on "The New Business Competition." This subject was discussed in its connection to local associations with a paid secretary, a permanent office, records, files, information and the filing of bids sealed or unsealed. The filing of open bids with the secretary entitles all those who have filed to know what other bids have been filed and no member is permitted to change his bid after filing it with the secretary unless he files an amended bid, so that others may know of his action. The estimate is thus one in open competition without pools on prices. Each contractor does his own estimating and stands upon his own and his competitor's honor. The man who is letting the contract is thus required to deal openly with the contractors and cannot misrepresent a competitor's bid for the sake of beating down the price.

There was considerable discussion for and against open competition.

The date of the next meeting was set for the week of January 20, 1915, at which time there will be a meeting of the Western Association of Electrical Inspectors and a local meeting of the American Institute of Electrical Engineers in Minneapolis and it is planned to have a joint meeting with these bodies.

The banquet was served at 7 p. m. on the porch of the Club House and did not break up until 10 o'clock. A number of salesmen, supply dealers, central-station representatives and visiting contractors were guests at the banquet.

There will be a good delegation of Minnesota representatives attending the convention of the National Association at Detroit.

New York's Greatest Office Building.

The new Equitable Building under construction in New York City, the largest and heaviest office building yet designed, is to be wired throughout with Simcore wire, made by the Simplex Wire & Cable Company, Boston, Mass. The specifications to date call for a total of more than 400 conductor-miles for distributing electric energy and lighting service throughout the mammoth building.

Among the Contractors.

One of the first garages in Kentucky to be operated in connection with an electrical contracting business is that of William Day, of Winchester, Ky. Mr. Day sees a big field ahead for the service he will give.

The Terrel-Hedges Electrical Company supplied the materials and made the installations in the house just built at Chattanooga, Tenn., by O. L. Bunn, secretary of the Chattanooga Manufacturers' Association. All of the materials in the structure were home products and all the work was done by Chattanooga concerns and workmen.

Electric wiring in the handsome new home of H. A. Hudson, at Lexington, Ky., will be done by H. B. Nelson, who has been given the contract.

The wiring and electrical work contract on the new Bowling Green Country Club, Bowling Green, Ky., has been let to Hubert Cherry, of Bowling Green.

J. S. Small & Company, of Ottawa, Kans., have secured the electrical wiring contract on the new gymnasium at Ottawa University.

Alex M. Knauber & Company, the well known contracting firm of Oak Park, Ill., has begun manufacturing Knauber's construction cleat, which bids fair to find very extensive use by electrical contractors because of the economy in construction it makes possible.

National Association of Electrical Inspectors.

THOMAS HENRY DAY, President, 59 Deerfield Avenue, Hartford, Conn.
H. S. WYNKOOP, Vice-President, Municipal Building, New York, N. Y.
WILLIAM LINCOLN SMITH, Secretary and Treasurer, Concord, Mass.
JAMES E. COLE, Representative on Electrical Committee of National Fire Protection Association, 11 Wareham Street, Boston, Mass.

Executive Committee
EUGENE N. DAVIS, Chairman, Brookline, Mass.

SECTION REPRESENTATIVES:
C. H. Fletcher, H. Burnes, British Columbia.
A. W. Hopkins, G. W. Perry, Western New England.
Washington Devereux, A. H. Lilley, Philadelphia.
E. N. Davis, H. A. Knight, Eastern Massachusetts.
C. A. Hannan, O. E. Smith, New York City.
C. W. Mitchell, John W. Carrell, California.

MEMBERS AT LARGE:
George L. Collison, Frank R. Daniel, James H. Fenton, F. G. Hartwell, J. E. Latta, James B. McCarthy, Thomas D. MacColl, A. A. Moffitt, R. P. Strong

"LET THE CODE DECIDE."

Secretary's Message.

The Secretary assumes that the members are now all looking forward to the vacation period within a more or less brief space of time, and sincerely wishes each one the precise kind of a vacation he most desires.

In this connection he may state that his own address during the summer, from the time this appears in print until the middle of September, will be William Lincoln Smith, South Orrington, Me. There is a splendid hillside covered with spruce and cedar behind the cottage at which the Secretary will spend his vacation and in front, two hundred feet below, lies the Penobscot, which is visible north and south for nearly twelve miles. There is a salmon weir in front of the cottage and the opportunities for using a fly rod are handy and convenient.

Now there is just one way for each man to be of very great assistance to the Secretary and thus enable him to depart on his vacation and enjoy his favorite pleasures with a clear conscience. This is *to send the Secretary one question* before he starts on his vacation. It is not much to do, but it will be of very great help to him.

Another thing the Secretary must again urge upon the Section secretaries, is for them to send him reports of their meetings. Of course, he does not expect information as to matters transacted which are of a private nature, many of which come up at any meeting of inspectors and the nature of which is well known to all of us; but he does expect, in accordance with the Constitution, reports upon such matters as may be of interest and value to the other members. Each Section ought to be able to furnish as a result of its meeting, some one subject and discussion thereon which may be published in these columns and be very helpful to all of us.

The Eastern Massachusetts Section met June 25 at New Bedford, but as these pages were on the press at the time and the secretary necessarily absent from the meeting, the report must lie over till the next issue.

In regard to the questions appearing in this issue, very little need be said. It seems to the Secretary that they bring out two or three points which are of value, in that they all appear to bear upon points which are very elusive.

The matter appearing in this section consists of questions on the National Electrical Code, its interpretation and meaning, and questions as to whether certain methods of wiring are in accord therewith. These questions are gladly received from anyone interested, even if not a member; they should be sent to the secretary with any needed elucidating sketch. They are answered by each member of the Executive Committee according to his knowledge of what the ruling would be in his jurisdiction.

It should be understood that no pretense is made to give an authoritative interpretation of the Code. This is a voluntary association; it has representation on the Electrical Committee of the National Fire Protection Association, which prepares the Code, but it has no right, and claims no right, to give a final interpretation of anything in the Code. It is only intended to give the interpretation which seems correct to the members of the Executive Committee. No attempt is made to edit or correlate the answers from the different members of the Committee, as it is felt that the occasional difference of opinion is calculated to lead to a further study of the matter in question, further discussion and the final clearing up of obscure points.

The aim is to help toward a better understanding of the Code on the part of all; a more uniform conception of its meaning; increased precision in applying it; and harmonious action of those using it, for the common good.

Thus Question 263, which is based on the requirement of Rule 26*b* that "the two or more wires of a circuit must be drawn into the same conduit," is to my mind of about the same nature as the question "How short must a piece of wooden molding be to become a cleat?", a thing which is not permitted in these days. Personally I have always objected to the wording "the two or more wires, etc.," because the whole expression simply means that one must as far as possible aim to keep the algebraic sum of the currents in the conduit zero. It is very easy to arrange wiring in a house, and I have seen several such cases, so that the wires are bunched in a conduit in such a way that the net effect is the cancellation of the effects of the currents in all but one wire, thus making the combined effect the same as if a single leg of one circuit were in the conduit.

Question 264 clearly does not contain sufficient data on which to base an opinion. Suppose the room referred to were a small concrete room in which the motor and pump were located, and that the gasolene pipe were attached to a tank-car outside the building and that a delivery pipe led to a large storage tank under ground, the pump and piping being made up thoroughly tight. Certainly, in such a case there would be no reason why the switch could not be located in the room.

I know one place where there is a tank underground outside the building and where a pipe comes in through the basement wall, runs about a foot below the ceiling for a distance of fifteen feet, and after turning a right angle, runs ten feet more, after which it turns another right angle and leads through the floor to a pump above.

The upper floor is a garage floor and car-repair shop. The basement floor, which is well cut off from the upper floor, is employed as a vocational school, woodworking shop, etc. Almost exactly under the gasolene pipe and near the first elbow there is located a 220-volt five-horsepower direct-current motor, not inclosed, and beside it are an open knife switch, cartridge fuses and a starting box. No criticism has come from the municipal inspection department, insurance inspectors, the state police who control garage buildings to some extent, or any one else, nor do I see exactly why any should be expected. The pipe is tight, but certainly there is as great a chance for a possible danger as under some conditions which fairly can be considered under the wording of Question 264. I should like to hear opinions on this point, for publication.

Arrangement of Wires Carrying Alternating Current in Metallic Pipes Used as Bushings.

Question 263. The Code requires that in alternating-current work in con-

duit, both wires of a circuit must be placed in the same pipe. In another section, without specifying alternating or direct current, iron pipe is allowed for bushing a hole if a porcelain tube is inserted. Under this rule may the two alternating-current wires be run through separate pipes, or must both wires be run through one pipe?

Answer 1(U). The latter part of Rule 26*e* states clearly that two or more wires of a circuit carrying alternating currents must be in the same pipe.

Answer 2(W). Separate pipes may be used according to the rules because technically this constitutes a bushing.

Answer 3(A). The iron pipe referred to in Rule 26*e* is for protection against mechanical injury to wires running through partitions or where brick fire stops are used. I see no objection whatever to running wires through separate pipes with bushings as they are never more than twelve inches long.

Answer 4(H). Rule 26*p* requires that the wires carrying alternating current must be in the same conduit and recommends that construction for direct current also.

Answer 5(P). While it is true that the Code requires all legs of an alternating-current circuit to be placed in one conduit, I do not consider that this applies to short lengths of pipe used as bushings, where the drop and heating caused by induction would presumably be insignificant.

Answer 6(O). There appears to be a slight conflict in the Code on this point but it is not likely to be of any serious importance. Obviously when metal tubes are used for bushing wires through timbers, walls, partitions, etc., separate tubes must be used for the wires in order to comply with the separation requirements for knob and tube work (or open work as the case may be). The provision for the use of metal tubes for bushing has been in the Code a great many years but is now seldom taken advantage of as porcelain tubes of any ordinary size and length are readily procured, or it is very easy to install sections of conduit or armored cable in difficult situations.

Answer 7(E). Under all conditions and circumstances all wires of an alternating-current system should be in the same piece of conduit, the length of the conduit, whether used as a bushing or in a conduit system, not altering the requirement. It is safe to assume that a mandatory wording in one part of the Code is not altered because the same mandatory wording does not appear in another part of the Code.

Answer 8(Q). For alternating-current circuits would advise two or more wires to be drawn in one piece of pipe regardless of circumstances.

Answer 9(T). Rule 26*e* is certainly definite enough.

Answer 10(J). Rules 26*e* and 26*p* require the two or more wires of an alternating circuit to be placed in the same pipe. Rule 16*d* relating to wires carried through a wall, covers a condition somewhat different from either of the above sections, in that the length of the pipe is considerably less and that the inductive disturbance is reduced correspondingly. In the case of an ordinary 660-watt lighting circuit no appreciable loss in pressure, or heating of walls will result from using separate pipes through a wall of ordinary thickness. But these losses increase rapidly with increasing current, and for large mains may assume serious proportions. However, I do not believe that the Code as now worded covers this case.

Answer 11(D). I should say install all wires in one pipe.

Answer 12(S). Rule 16*d*, which governs this type of installation, does not consider it as conduit work, and wires may be in separate pipes under the rule.

Answer 13(N). This clearly refers to the passing through a partition or wall in knob-and-tube or open work, or possibly the entrance to a building of brick, stone or concrete outside-wall construction. It has nothing to do with conduit work nor the special case of protection on side walls. If both wires are put in one tube, one violates the spacings for knob-and-tube work, etc. If the circuit is run through two pipes, one violates the rules governing alternating-current wires in conduit or iron pipes. Either way one infringes on some rule and one must take one horn of the dilemma. If it is a stud partition with lath and plaster one need not use iron pipe at all. In a brick partition one certainly may use two pipes if one desires as one will have to obtain large currents before hysteresis will make any trouble and reactance drop is of course, utterly negligible. Still it seems to me that the cost of punching holes for two pipes, etc., would most likely be more than that involved in using one pipe with no porcelain bushing inside but with a separately bushed porcelain-faced terminal on each end. The single-braid question, which is another technical infringement, is of no importance with only 18 inches of pipe at the outside, or with flexible tube and simple pipe-bushings.

Answer 14(M). Rule 16*d* with its specifications should govern. The length of bushings would limit the length of pipe, which therefore would be rather short and the induction effects would not be serious enough to make it necessary to resort to regular conduit construction.

Answer 15(Y). I should say both wires must be separately incased in flexible tubing extending from the insulator next below the pipe to the one next above it, and the wires both put in the same pipe.

Answer 16(P). In all cases where alternating current is used, all the wires of a circuit must be in the same pipe. If it is necessary to use an iron pipe where passing through a wall, but one pipe may properly be used in which the wires of the circuit are properly insulated from each other by additional approved tubes.

Answer 17(L). The intent of the Code is evidently to require all wires of an alternating-current circuit to be placed in the same metallic raceway. See Rules 26*e*, 26*m*, 26*p*, 27*g* and 29*e*.

Locating Motor Switch Near Inflammable Volatile Liquids.

Question 264. Would it be proper to install a motor switch in a room where there was a motor and a rotary pump, the rotary pump being used to pump gasolene into a closed tank?

Answer 1(U). It would be improper to install a motor switch in a room where there was a gasolene pump, Rule 19*b*.

Answer 2(W). It would not unless inclosed in a gas-tight case.

Answer 3(A). I should think it proper if the switch is not less than five feet from the floor and that there would be just as much danger from the motor as from the switch.

Answer 4(H). I doubt if the Code covers this question except in a general way. I should be very slow to authorize the use of either the switch or the motor in any room where gasolene is being pumped.

Answer 5(P). If it is necessary to install a switch in such a location I would recommend the use of a marine-type switch. I should also be particularly careful to have a completely in-

closed-type motor set as far above the floor as possible.

Answer 6(O). Under Rule 19*b* switches and fuses would not be considered safe in a room where gasolene vapors are liable to exist. Such cases as are described in the question must necessarily be special and each treated according to the conditions. Every reasonable safeguard is justifiable where there is risk of explosion.

Answer 7(E). No. It would be most improper and not in accordance with Section *b* of Rule 19, which in part reads, "or where exposed to inflammable gases," etc.

Answer 8(Q). No.

Answer 9(T). Read Rule 19*b*.

Answer 10(J). I should rule that the possibility of inflammable gases being present at some time due to leakage of gasolene would bar the installation of switch as proposed. The locating of a motor in such a room would also be condemned except in the case of a straight induction type of motor without commutator brushes or sliprings.

Answer 11(D). Install cutout and switch in vapor-proof inclosures.

Answer 12(S). If the room were well ventilated I should say "Yes." If it is not well ventilated I do not think it would be a safe installation, with either switch or motor within the room.

Answer 13(N). This question is too indefinite to be answered by simply the words "Yes" or "No." We do not know whether the gasolene tank is in the room, a large storage tank like a tank car outside, or whether there is a tank buried in the ground. Neither do we know the type of motor, nor the type of switch. The requirements would be all modified by these things. An inclosed three-phase induction motor with marine-type switch could be hitched directly on to the pump and motor in one unit without risk. A direct-current open or semi-inclosed motor with a starting box might be very dangerous.

Answer 14(M). The requirements all depend upon size of room, ventilation, type of motor and fittings, etc.

Answer 15(Y). Hardly, unless the switch were of iron-clad oil-break type.

Answer 16(L). I think there is no reference in the Code to this condition.

Answer 17(B). I think the motor switch should be outside of the room where the pump and gasolene tank are located.

Grounding of Conduits.

Question 265. Is a copper plate with wire soldered thereto and buried in the earth permissible for grounding a conduit in a building with no water-piping connection.

Answer 1(U). Ground should be made as specified in fine-print note of Rule 15*g*.

Answer 2(W). Certainly, Rule 28*f*.

Answer 3(A). It is permissible and method of construction can be found in Rule 15*g*, fine-print note.

Answer 4(H). Yes, if the size of plate and type of construction conform to the fine-print note of Rule 15*g*.

Answer 5(P). Yes the Code accepts copper plate as "a suitable ground."

Answer 6(O). The question of whether any particular form of ground is approved must depend on the interpretation given by the inspection department of the words "other suitable ground" and "permanent and effective" in Rule 28*f*. The inspection department should standardize its practice on such matters as far as possible so as to obtain uniform rulings. In this jurisdiction a conduit ground in order to be considered effective is required to have such conductivity that the main fuse on the installation can be blown by a current passed through the conduit ground at the voltage of the system.

Answer 7(E). It is permissible when the copper plate is large and heavy enough and the ground wire is riveted in a number of places and soldered to the plate its entire length. It would be well also to paint the plate at the point where wire is secured to it with a water-proof compound to prevent corrosion.

Answer 8(Q). Yes, if no water pipe is available.

Answer 9(T). Yes, if constructed along lines indicated by the several paragraphs of Rule 15*g*.

Answer 10(J). Yes, Rule 15*g*.

Answer 11(D). Yes, see fine-print note, Rule 15.

Answer 12(S). Yes, if properly buried and if the ground wire is soldered and riveted to the plate.

Answer 13(N). Yes, the "suitable ground" called for in Rule 28*f*, however, is in many such cases more or less a matter of geological formation, but I think the best thing to do is to ground the wiring according to Rule 15 and to ground the conduit through separate ground connections to the same ground plate or length of pipe, buried below permanent-moisture level. In the lead to the same from the conduit, a current-limiting reactance, or resistance if necessary, should be inserted to limit the flow of current to a value which will blow out the main fuse in case of a leak.

Answer 14(M). Must have a suitable ground under Rule 28*f*, and the fine print under Rule 15*g* describes a suitable ground.

Answer 15(Y). Yes, if properly installed as specified in fine-print note of Rule 15*g*.

Answer 16(L). Yes, under normal conditions.

Answer 17(B). A copper plate with wire riveted and soldered to same and properly buried in the ground as provided for in the latter portion of Rule 15, would be satisfactory.

Civil Service Examination for First-Class Steam Engineers.

The United States Civil Service Commission will hold a competitive examination at the usual places on July 8 for first-class steam engineers. This examination will be used to fill a vacancy in the position of assistant engineer and electrician at $1,200 a year in the United States Penitentiary, Atlanta, Ga., and similar vacancies that may occur in departmental service at Washington, or in other government buildings or institutions. In the examination, 65 per cent credit will be ascribed to practical questions in mechanical and electrical engineering, relating particularly to the construction and operation of the heating, electric lighting and elevator plants in first-class public buildings; training and experience will also be given considerable credit.

Applicants must be over 20 years of age and should write to the Commission for application form 1312, stating also the title of the examination for which application is desired.

The Marconi Wireless Telegraph Company is reported as having concluded a large deal with the Chinese Government by which the company gets a $10,000,000 contract to construct numerous wireless stations in China. The company will receive a royalty of 15 per cent on the receipts from the Chinese stations for 25 years.

Public Service Commissions

Conducted by William J. Norton

ARIZONA.

Overhead Line Construction. The Corporation Commission has issued an order requiring that all telephone, telegraph, signal, trolley, electric light and power lines be constructed and maintained in conformity with the specifications applying to the classes of lines, contained in the report of the Committee on Overhead Line Construction of the National Electric Light Association, at its thirty-fourth convention, held in New York City in 1911. The order provides that modifications and additions to these specifications, made by the Association shall, upon approval of the Commission, be in full force and effect with relation to such construction within the State. The companies are to conform to these requirements within a period of five years from the date of the order.

CALIFORNIA.

Ojai Power Company was authorized to issue capital stock of the par value of $19,200. The money realized from the sale of the stock will be expended in the purchase of additional electrical equipment.

DISTRICT OF COLUMBIA.

Oliver P. Newman, one of the three commissioners of the District of Columbia appointed by President Wilson, was declared by the verdict of a jury in the Supreme Court of the District of Columbia to be ineligible to that office, on the ground that he has not been a citizen of the District three years prior to his appointment as required by law.

ILLINOIS.

The Public Service Company of Northern Illinois was authorized, June 19, 1914, to make certain reductions in its Rate A. General Lighting Service, affecting various cities and towns. The rates effective July 1, 1914, are as follows: 14 cents per kilowatt-hour for the first 30 hours' use of maximum demand and 8 cents for all excess use. Subsequent reductions were approved as follows: effective September 1, 1914, 13.5 cents per kilowatt-hour for the first 30 hours' use of the maximum demand and 8 cents for all excess use; March 1, 1915, 13 cents per kilowatt-hour for the first 30 hours' use of maximum demand and 8 cents for all excess use. A prompt-payment discount is provided of 1 cent per kilowatt-hour if bill is paid in ten days.

The Montgomery County Telephone Company was authorized to abolish certain concession charges and to substitute the standard rate in effect for the class of service furnished. The rates eliminated were found to be discriminatory.

Physical Connection of Telephone Lines. The petition of J. D. Leaf and Roy Vanderbrock asking that the Alhambra Mutual Telephone Company be required to make a physical connection of its lines with the petitioners' telephone system, was dismissed. The Commission held that public convenience and necessity did not require the connection.

The Western United Gas & Electric Company was authorized to issue $32,000 of five-per-cent bonds redeemable, after February 1, 1915, and before February 1, 1950, at 103 per cent of par value and accrued interest, to be sold so as to net the company not less than 92.5 per cent of par value.

INDIANA.

The Indianapolis Telephone Company filed a supplemental schedule with the Commission for a new class of service, listed as the registered call service. When the party called cannot be secured the call is to be registered in the company's office with the number of the party placing the call, and at the first opportunity these calls are to be reported to the subscriber. It is proposed to make a charge of $1 per month for this service for offices and 50 cents per month for residences.

NEW YORK.

The Albany & Southern and the Red Hook Light & Power Company. In the dispute between the companies in regard to furnishing electric current in the town of Greenport, the Commission has issued an order permitting the Albany & Southern to exercise the franchises in territory it now occupies in Greenport north of the City of Hudson and the Columbia Turnpike. The Red Hook Company is restricted to the territory south of this division.

The Syracuse Lighting Company was authorized to issue $434,000 six-per-cent ten-year gold bonds for extensions and improvements.

The Consolidated Electric Company of Greenwich, is permitted to exercise a franchise for the construction of an electric light line for a distance of two miles on the main highway between Middle Falls and Schuylerville.

The New York Railways Company has served upon the First District Commission a writ of certiorari issued by Justice Greenbaum of the Supreme Court, requiring the Commission to produce in court for review, the record in the case of the company's application for permission to issue $1,500,000 in bonds, which the Commission allowed to the extent of $640,000. The purpose of the bond issue was to provide funds to reimburse the company for money expended by it in the acquisition of 175 new cars of the stepless type to replace an equal number of old cars. The Commission held that only $2,800 per car of the value of the old cars could be capitalized.

OHIO.

The West Liberty Light & Power Company was authorized to purchase the Chester A. Hartzler electric light plant for the agreed price of $7,500.

The Greenville Electric Light & Power Company was authorized to issue its common capital stock of the par value of $28,000 to be sold for the highest price obtainable and for not less than par value. The proceeds are to be used for the construction of improvements and additions to its generating station.

PENNSYLVANIA.

Bell Telephone Company. The Commission has issued a holding that the Bell Telephone Company has the right to indicate what attachments shall be placed upon its instruments installed for patrons and cannot be compelled to attach foreign appliances.

WISCONSIN.

Watertown Gas & Electric Company. The Commission on June 25 handed down its decision in the matter of the City of Watertown vs. Watertown Gas & Electric Company. The complaint related to the rates to be charged for street lighting on the basis of the present equipment which consists of 102 seven-ampere series alternating-current inclosed arc lamps. Charge was made for this street lighting service on the basis of a franchise agreement entered

into March 1, 1903. The rate was $70 per lamp per year for the first 70 lamps and $66 per lamp per year for all lamps in excess of this number. The Commission was also asked to pass upon the probable cost of operating a system of street lighting consisting of four-ampere magnetite arc lamps in place of the present type of lamp.

The question of the cost of power was made an issue in the case. The Watertown company operates a hydraulic plant and when this plant cannot be operated receives current from the water-power plant at Kilbourn through the agency of The Milwaukee Light, Heat & Traction Company, or from Milwaukee through the agency of The Milwaukee Electric Railway & Light Company and the Milwaukee Light, Heat & Traction Company. All of these companies are closely related and are controlled by the same interests. For this reason the city of Watertown contended that no allowance should be made in excess of cost for current purchased on contract agreement from either of the companies noted above. The Milwaukee company did not rely upon its contract but claimed that it ought to be allowed a profit above cost on the current sold to the Watertown company because it contracted for a large amount of current and guaranteed a high minimum rate. It was claimed that such low rates could not be obtained by the Watertown company if it contracted direct.

In making an allowance for power costs the Commission considered (1) the cost of producing current at Watertown hydraulic plant with steam reserve equipment at the same place; (2) cost of producing entirely by means of a steam plant at Watertown; (3) cost of receiving current from Kilbourn water-power plant and using a steam reserve located at Watertown; and (4) cost of producing current at Watertown hydraulic plant, receiving current from Kilbourn plant and using steam plant at Milwaukee as a reserve. Recognition was given to the principle that savings due to economy are to be divided between producer and consumer.

Other questions raised related to depreciation of street-lighting equipment, expense of operation and maintenance, apportionment of investment and expense, and proper allowance for interest and profit.

The Commission estimated the yearly cost for each four-ampere series magnetite arc at $55. These arcs were to operate on an all-night dark-night schedule of from 3,200 to 3,400 hours per year. This was not made the subject of an order, however, as the city has not decided to install magnetite arcs. The Commission ruled that for the present lighting systems the price per arc could be reduced to $57 per year. This will effect a saving of $923 per year over present rates.

Richland Center Electric Light & Water Plant. The municipality of Richland Center applied to the Commission for authority to revise its electric and water rates to provide a graduated scale of rates and minimum bill for power and to install a separate and higher rate for electric and water rates to consumers living outside the city limits.

The Commission rules that in selling its product to non-resident consumers the municipality acts in much the same capacity as a private enterprise. Such higher charges, the Commission points out, are not discriminatory providing the difference in charges between non-residents and residents is not disproportionate to the elements which make such a difference proper. One of the reasons why a city may charge non-residents more for service is that it has no control over these consumers in the way of placing their bills on the tax rolls. The increases are allowed as prayed for in the petition and in instances where it was left to the Commission to establish charges, rates determined in an informal proceedings were ordered in effect.

The Eleva Farmers Telephone Company made application to the Commission to increase rates. The petition states that the rates now in force are not sufficient to provide for depreciation and interest and therefore discriminate against the stockholding subscribers because they are required to make up the deficits from operation.

The Commission allowed the company to establish the rates asked for in the application. In addition a two-party residence rate was ordered in effect. The decision was rendered on June 20.

Wisconsin-Minnesota Light & Power Company was authorized to issue $988,000 of common stock, $1,700,000 of preferred stock and $3,750,000 of first and refunding stock. The authorized issue is to replace securities of the LaCrosse Gas & Electric Company and to acquire properties of the Chippewa Valley Railway, Light & Power Company and the Chippewa Valley Construction Company.

Australian University Desires Technical Data.

The Engineering Faculty of the University of Western Australia, Perth, Australia, which was established as an engineering school in 1913, is anxious to be placed on the mailing lists of manufacturers of machinery used in electrical, mechanical, mining and civil engineering, and also on the mailing lists of firms making measuring, testing and other laboratory apparatus. Such information will prove of value not only to students but to practicing engineers, as it is now often difficult to obtain information quickly in a place as isolated as Western Australia.

Kansas City Electric Club Holds Special Meeting to Boost Metropolitan Franchise.

The Kansas City Electric Club, which recently adjourned for the summer, was stirred to action by the campaign for an extension of the franchise of the Metropolitan Street Railway Company, of Kansas City, and held a special meeting on June 30 at the call of President W. J. Squires. Sentiment at the meeting may be gathered from the statement of one member that he "intends to vote six times for the franchise." The election is to be held on July 7. If the franchise passes, the company is pledged to build slightly more than 15 miles of new track, and to establish a car-manufacturing plant.

Gas-Filled Lamps Used in New York Illumination.

Incandescent lamps of 5,000 candlepower are being used in the Fourth of July illuminations by The New York Edison Company. They have been placed on the tops of poles 25 feet high to illuminate the parks, among other placed at Riverside Drive and Ninety-seventh Street, and the Playground in 101st Street from Second to Third Avenues. Gas-filled lamps of 2,000 candlepower each are used in the band stand at City Hall Park, Grant's Tomb, and Washington Square. Park Avenue from 112th to 114th Streets, under the New York Central Railroad tracks, where the folk dancing will take place tonight will also be brilliantly lighted by these new powerful and efficient lamps.

Tower Lighting for Railroad Yard.

A new system is being tried out by the Pittsburgh & Lake Erie Railroad Company for the lighting of its classification yard at McKees Rocks, Pa. Eight steel towers 100 feet high at the top of which are powerful electric arc lights have been erected in the yard. The towers are of structural steel with a twelve-foot base, and are about a foot square at the top. Instead of being located throughout the yard they are placed around the outside so that the light is thrown down into the center. The yard is about 450 feet by 2,500 feet and the illumination produced by the lamps is strong enough to enable the workmen to read their orders at night in any portion of the yard.

Among the Supply Men

Windows That Sell Goods.

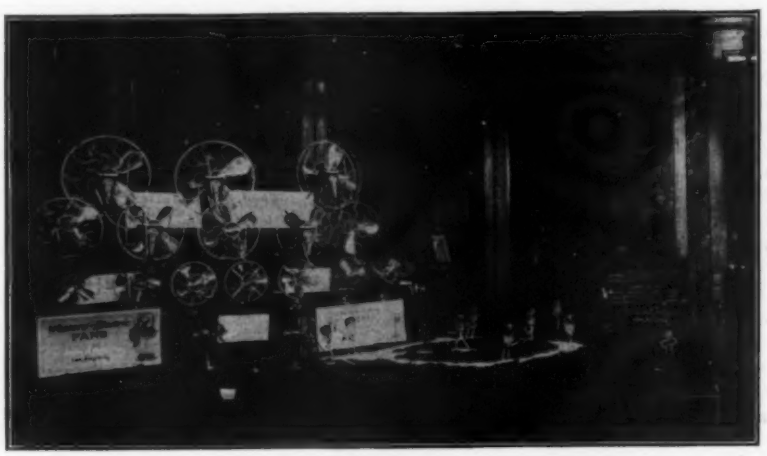
The electrical shop of today handles as an indispensable part of its stock a vast variety of devices for convenience and comfort—and, incidentally, for the consumption of electric current—such as fans, toasters and broilers, percolators, curling-irons, warming pads, and the like, in addition to the usual selection of bulbs and fixtures. This is more or less a recent development, but it is one which has converted the dealer in electrical appliances into a retail merchant. If it has not done so in a given case, the chances are that the dealer is not by any means as successful as he might be, because it takes real merchandising and real salesmanship to sell these goods, especially in view of the active competition to be found.

Reflections along this line, coupled with a desire to assist in arousing general interest in current consuming devices, were responsible for the Cincinnati house of the Western Electric Company taking up the study in an up-to-date and effective manner. While they have used the best of methods to arouse interest in other ways, it is probable that the unusual cruiosity-exciting windows, which are always to be seen in the company's store, have played the largest part in their success.

For example, a week or so ago, one passing the place at almost any time when people were to be found on the street, would have seen groups of varying proportions gathered before the window, gazing interestedly in. And they had something to gaze at, there being a ball game in full swing, the participants of which were nothing more nor less than electric light bulbs. The window had imitation grass on the floor. A baseball diamond was laid out with the paths between the bases marked off in sand. The players appeared in their regular positions.

The players were what caught the eyes of the crowd. As stated, they were electric light bulbs—40-watt frosted Mazdas of the regular sort—but some clever member of the staff had painted black hair and features on them, making them appear quite human. They stood on legs of twisted wire, and the "man" at the bat held a stick, adjusted to his size, in the shape of a regulation bat. As the scoreboard in the corner showed, it was a hot game between the Western Electrics and another team, with the score at 2 to 1 in the ninth inning.

By means of a cylinder flasher, one bulb after another in this window flashed on and off, indicating the movements of the ball, just as the automatons do when used in reproducing actual games. The window showed only the hot ninth inning, in which the opponents of the Western Electrics went out in one-two-three order, the scoreboard stating it as follows: "First man grounds to third—one down; second man flies to center—two down; third man grounds to short—three down and Western Electrics win, as usual."



Window Display of Fans—Figuratively and Literally Speaking.

The passers-by at the window were not the only spectators of the game, however, for a grandstand in another corner was occupied by a group of Western Electric fans—literal electric fans, of course—first one and then another of which buzzed excitedly at the various plays pulled off. This was done the stage-manager of the performance states, by contact points on the same flasher that operated the bulbs, the last half of the ninth inning being produced regularly by the slow movement of the cylinder.

"This is the second time we have used that window this season," said the manager recently. "We put it in early in the season, when interest in baseball was first awakening, and it proved a winner; and then lately, with interest in the Cincinnati team at fever height and the warm weather making fans particularly seasonable, it struck me that it would go well again. And it has. It is an actual demonstration, you see, both of the fans and the bulbs, and it has sold both, although, of course, the fans have been the best sellers, and are the line for which the window was made.

"Another highly successful fan window which we used recently was one reproducing a snowstorm effect, by means of fans so placed as to make a continuous current of air in the window, keeping the imitation snow in a constant whirl of motion, just as the wind does at a gusty corner in midwinter. The snow we used was made up of a judicious mixture of paper confetti and French chalk, such as is used in making a dancing floor smooth. This latter material served both to frost the window very realistically and to keep the confetti from sticking together.

"Windows of this sort are not particularly uncommon, but it is rather difficult to get one to work effectively. The correct placing of the fans can be managed only by experimenting and finding out just how to get the desired swirling current of air. In this window we were so successful in this respect that the 'snow' was swept clear to the top of the window, giving the breeziest effect you ever saw. Moreover, this window was used at a time when we were having extremly hot

weather, and its coolness was all but irresistible, as the mounting of our sales showed conclusively. It was a fan window, pure and simple, demonstrating effectively the kind of breeze that electric fans can produce; and it produced business as well as breezes."

One of the most elaborately staged windows which has ever been used at the store was that showing the use of the modern warming-pad, heated by electricity, as compared with the old-fashioned hot-water bottle. In the corner of the window were heaped a number of rubber bottles, the pile being significantly labeled, "Dump." The rest of the window was given over to a clever display showing the electric warming-pad in use.

An old barrel, properly dissected and covered with muslin at five cents a yard, made a most attractive bed, in

Timely Window Display of Electric Fans.

which a large doll, contributed temporarily by a little daughter of one of the force, was placed as the suffering patient, while another large doll was dressed in a regulation nurse's uniform. The patient was carefully covered up save at the feet; where the white covers were thrown back showing the nurse in the act of applying the soft and comfortable warming-pad. In connection with this demonstration of the up-to-date method of warming a sick person, cards called attention to the actual danger from the use of hot-water bottles, by leaks or breaks permitting scalding water to escape.

Other windows have been used from time to time, some of them embodying actual demonstrations of electrical devices in use, as electric irons and cooking devices; others being displays of the goods alone. One of the former sort, which worked remarkably well, was that showing the electric stove in action. The window was piled high with the devices, leaving only a small space in the center and front where a man showed how they worked. He was surrounded by electric stoves on which water was boiling, bread toasting, and various other culinary operations going on, attending which kept him busy.

Windows are changed at this store weekly, a new one being placed every Friday, ready for the Saturday crowds. Much thought, time and trouble are devoted to them, as may be gathered from those described, but inasmuch as results are secured, the work given can hardly be regarded as other than well spent.

The experience of this store, as well as of many others all over the country, indicates pretty clearly the truth of what was said above—that the dealer in electrical goods must be a merchant not second in enterprise and activity to the merchant in any other line. The old-fashioned dealer, who thinks it sufficient to place a few fixtures and fans in the window when he opens his shop, and to leave them there unchanged for months, cannot expect to sell goods in competition with the energetic salesmanship of the shops that draw on the limitless possibilities of life and motion offered by electricity for use in their windows; and that is one of the best reasons why the old-fashioned dealer is disappearing. He either ceases to be old-fashioned, by waking up to his opportunities, or he decides that the business is too crowded.

Chicago Jobbers and Wire Manufacturers Enjoy Big Day at Golf.

On Tuesday, June 30, 17 leading electrical supply jobbers and manufacturers in Chicago made a trip to the Belmont Golf Club through the courtesy of N. G. Harvey, general manager of the Illinois Electric Company, and enjoyed one of the best days at this popular sport that the Chicago contingent has had in a long time. Fine playing and close games were the order of the day, the play being split up into four foursomes. Those participating included A. B. Conover, of the John A. Roebling's Sons Company; Malcolm Carrington, Westinghouse Electric & Manufacturing Company; E. H. Hammond, American Electrical Works; A. W. Gabriel, Hazard Electric Manufacturing Company; Joseph P. Belden, Belden Manufacturing Company; Ray Hixon, Simplex Electric Manufacturing Company; I. A. Bennett, I. A. Bennett & Company; M. B. Austin, M. B. Austin & Company; W. A. Browne, M. B. Austin & Company; W. P. Crockett, W. P. Crockett & Company; C. J. Litscher, C. J. Litscher Electric Company; W. W. Low, Electric Appliance Company; W. R. Hoagland, Western Electric Company; Franklin Overbagh, Overbagh & Ayers Manufacturing Company; N. G. Harvey, Illinois Electric Company, and A. A. Gray. P. H. Lyons, National India Rubber Company, was also of the party.

Low gross score of 93 was made by Mr. Hixon, and 99 was made by Joseph P. Belden. A kicker's handicap against blind bogie divided a purse of $32. Overbagh and Conover divided first and second prize, Gray taking third prize, Harvey fourth, Belden fifth and Low and Hoagland splitting the sixth prize.

The Metropolitan Electrical Supply Company, 180 West Lake Street, Chicago, is making a special sales campaign on Sprague and General Electric fans. The company has equipped several of the prominent summer gardens in and around Chicago. The Rienzi cafe, restaurant and summer garden at Diversey Boulevard, Broadway and Clark Street, Chicago, has installed a complete equipment of ceiling fans. A feature of this installation is the equipment of the outside pergolas with seven of these fans, securing absolute freedom from flies.

L. A. Schwab, president of the Monarch Electric & Wire Company, Chicago, Ill., announces that advance sales of fans have been up to his estimates, and he believes that the season's business will close with an entirely satisfactory demand. Conditions of general business in certain parts are slow, while in others they seem to be quite active. Generally speaking the business of this company is satisfactory.

American Institute of Electrical Engineers.

Annual Convention Held at Detroit, June 22-28.

The thirty-first annual convention of the American Institute of Electrical Engineers was held at the Hotel Pontchartrain, Detroit, Mich., June 22 to 26. The first session was called to order by President C. O. Mailloux at 10:30 a. m. on Tuesday. In his presidential address Dr. Mailloux spoke of the growth of the Institute and its work, and the effective service which was rendered by its committees. He discussed in great detail the evolution of the Institute and of its members, socially and civically. He thought that all electrical activities should be centralized in the Institute and he deprecated the formation of separate societies in different divisions of applied electricity. By concentrating these activities in one body the load-factor would be improved through the diversity of subjects covered and a larger audience would be reached in the presentation of papers. We can usually discern the needs of others, but are not so quick to realize our own. Most of us are followers of the pioneers, when we ought to be leaders in our own subjects. He referred to the lack of the guild spirit among engineers, who as a class do not receive the proper recognition from other classes and do not take the place which they should in social and civic affairs. The practitioners of law, medicine, the fine arts, etc., exert a force and hold a definite position in society. They are recognized by other classes because they insist upon recognition. The engineer has progressed from a lower rank in society, as is evidenced by the fact that in the navy the engineer at one time ranked below a carpenter. To receive proper recognition engineers must assert themselves as a class. This would result in even more good to society than to themselves, so the motive may be regarded as altruistic. In the decision of public engineering questions they should displace the lawyers and politicians who now dominate such decisions. As a class engineers recognize their own limitations, and consequently do not assume enough initiative in conducting affairs. Too little attention is given to the cultivation of professional ideas outside of the Institute. Our place is really fixed by what others think of us, and not by what we think of each other. It is consequently necessary to show the public that engineers are as well qualified as other professional classes to take a dominant position in public work which is concerned with engineering, such as positions on public-utility commissions.

D. B. Rushmore expatiated along the same line of thought and expressed confidence that the engineer would ultimately come into his own.

The session was then turned over to the committee on Electricity in Marine Work, and H. A. Hornor, of that committee, was called upon to preside. The first paper was by C. S. McDowell and D. M. Mahood, entitled "Electric Heating as Applied to Marine Work." Mr. Mahood presented the paper.

Electric Heating in Marine Service.

Electricity is being adopted to a great extent for space heating in marine work because of the simplicity and low cost of installation, saving in weight, freedom from leaks, noises and disagreeable odors as compared to steam heat, availability for heating of individual rooms, ability of placing heaters where most efficient, portability so that storerooms and other seldom-used spaces may be readily heated when desired, ease of regulation so that individual staterooms, etc., can be maintained at any desired temperature without affecting the whole system. A comparison of convector and radiant heaters is given, the proper use of each type is shown, and the conclusion drawn that for space heating on shipboard with metal decks and bulkheads, the convector heater is most efficient. Curves are given showing results obtained on tests to determine the best type of heater for shipboard and desirable features of heater are indicated.

For each 1,000 cubic feet of space, 1,500 watts input is required to maintain the temperature of air space of staterooms at 70 degrees fahrenheit based on the heater being installed in the center of the space, having an average height of 7.5 feet, and also based on replacing the air at outside temperature of 32 degrees every quarter hour. Other arrangements may reduce this to 1,100 watts. The cost of generation of electricity aboard ships having boilers already installed for propulsion is about one cent per kilowatt-hour and in some cases is less than this value. At such a low cost of generation, the great objections met with on land installations of electric air heating, where the cost is as high as fifteen cents, do not prevail. It interferes very little with the lighting load, thus increasing the load-factor, and seldom requires extra generator capacity.

Written discussion submitted by W. S. Hadaway, Jr., was read by W. C. Smith. He found the great value of the paper to be in showing that the same wattage might have different effects according to the method of application. He questioned some of the results shown by the authors, but considered that their general conclusions were encouraging.

A. E. Waller expressed interest in the curves, which showed that the open coil gives more rapid heating than the closed coil heater. Other advantages of a protected coil are, however, of more importance, and the slight difference in the rate of temperature rise is of little importance. Repairs are an important item, and the resistance should be protected from moisture. At the same time the coil can be protected from mechanical damage, oxidation, etc. In case of burnout there is danger with an open coil of metal dropping from the heater and damaging floor coverings, etc. Painting the surface is of importance, since the nature of the surface determines the heat flow.

C. D. Knight referred to the importance of heating a large volume of air slightly, rather than a small volume to a high temperature. He estimated that with current at one cent per kilowatt-hour it would cost $400 to heat a house which would require $125 by the use of ordinary methods.

F. C. Caldwell pointed out the usefulness of the radiant heater as an auxiliary, since the heat can be thrown just where it is wanted. The cost is sometimes thought to be prohibitive, but such is not the case for occasional or emergency use. Another very convenient application of electric heat is the electrically heated blanket, which he had found especially suitable for out-door sleeping.

H. A. Hornor pointed out that the paper applied especially to battleships having metal bulkheads, and that the same conclusions would not apply to vessels having wooden bulkheads.

In closing the discussion Mr. Mahood said that adaptability should be the criterion in choosing between the open and protected units. The cost of one cent per kilowatt-hour mentioned in the paper applied only to operating cost, and did not include depreciation or fixed charges. The radiant heater is not useful for space heating and is hence not so well suited as the other types to marine work.

H. F. Ford then presented a paper entitled "The Electrically Driven Gyroscope in Marine Service."

The Electrically Driven Gyroscope in Marine Work.

The gyroscope when continuously driven by electric power may be used for various purposes, many of its applications having especial value in marine work. Small gyroscopes are used to establish base lines for the measurement or control of angular mo-

tion. The gyro-compass makes use of the earth's daily rotation and consequent changing direction of gravity to secure a directive force a hundredfold greater and more accurate than that of the magnetic compass. A general description is given of the gyro-compass as adopted by the United States Navy for use on all the battleships and submarine vessels. Many electrical and mechanical devices have been developed to perform the various functions whereby an instrument of great precision has been secured. Large gyroscopes are made which are capable of counteracting enormous wave forces and completely stabilizing any ship against rolling in the heaviest seas.

D. B. Rushmore opened the discussion, speaking in appreciation of Mr. Sperry's work.

A. E. Waller asked some questions, and Mr. Ford then explained the application of the gyroscope in preventing the rolling of a ship and in causing rolling in cases where it was desired, as in breaking up ice or preventing the freezing in of a vessel. It may be placed in any part of the vessel where it can be rigidly attached to the frame. The stabilizer will weigh about 0.1 per cent of the weight of the vessel. The gyroscopic compass can be used in latitudes as high as 80 degrees satisfactorily.

At the session on Tuesday evening Rudolph Tschentscher, chairman of the Industrial Power Committee, presided. In opening the meeting he advocated the establishment of a technical committee on the iron and steel industry, and gave some statistics, showing the magnitude of it. Plants having their own generating stations represent a capacity of 400,000 kilowatts, and the total motor capacity reaches 1,300,000 kilowatts. In 1913 the energy consumption was about 2,000,000,000 kilowatt-hours.

R. H. McLain then presented a paper entitled "Direct-Current Motors for Coal and Ore Bridges."

Direct-Current Motors for Coal and Ore Bridges.

This paper gives a brief description of the mechanical arrangement of a coal bridge. The bridge consists essentially of a trolley car with hoisting mechanism for a self-filling bucket. A series-wound motor is recommended for driving the trolley car; and the proper method of gearing the motor for the most economical results is discussed. A series-wound motor is well adapted for this service because it exerts about 50-per-cent greater torque per ampere on starting than on running. This feature makes a considerable saving in power consumption and power peak, as well as in the size of the motor, because most of the work of this motor is the starting and stopping of the trolley. The usual acceleration for the trolley is 1.5 to 2.5 feet per second per second. For hoist service we have the choice of series, compound or shunt-wound motors. The conditions which affect the choice are voltage variation, amount of power available, height of hoist and time required for the trip. A series-wound motor is recommended for a low-speed hoist and a shunt-wound motor for a high-speed hoist. The relative merits of the two methods of winding the motor are considered. Electricity for coal and ore-bridge operation is now a necessity. No other form of power is capable of being transmitted so readily to the place where it is needed for use. Electricity has proved to be far cheaper than steam for this purpose. Practically all of the unloading of boats on the Great Lakes is done with electric power.

Before opening the discussion President Mailloux announced the death of Mrs. George Westinghouse and the sending of a message of sympathy from the American Institute of Electrical Engineering through C. W. Stone, who is a relative of the family.

D. B. Rushmore then opened the discussion by pointing out that the subject of the paper was a good example of the engineering problem of motor application. Different elements have the greater importance in different applications. In some cases speed is the first consideration, in another efficiency, and in another first cost, etc.

T. E. Tynes discussed the problems of control in ore bridges. He told of using two motors in series for bridge movement and in parallel for hoisting. Dynamic braking is utilized in the parallel connection.

H. B. Lindsay inquired as to whether braking is usually done by electrical means. In reply Mr. McLain said that friction brakes were originally used, but braking is now dynamic in all cases exceeding five horsepower. In smaller sizes the practice is not uniform.

T. E. Tynes then presented a paper entitled "Method of Keeping Down Peaks on Power Purchased on a Peak Basis."

Methods of Keeping Down Peaks.

The author mentions two general ways of reducing peaks, the first being to furnish the peak power from a separate source such as a local steam tubine, and the second to store some of the power furnished by the power company, which is given up later when the peak demand comes on. In the case of the plant described by the author a mixed-pressure turbine was installed to take the peaks, this being selected on account of available exhaust steam from pumps, air compressors, etc. The turbine is direct-connected to two direct-current generators mounted on a common bed-plate. The first plan tried was to use a motor-driven rheostat operated with clutches which in turn were operated by solenoids energized by current controlled by a contact-making ammeter. After the installation of a maximum-demand meter which integrates the one-minute peaks, the rheostat control was found to be too slow and a special peak-taking device was then installed. This device consists of a rod carrying points which successively make contact with mercury cups and which is operated by the moving element of the graphic meter. These mercury contacts close relay circuits which operate to short-circuit sections of resistance in the field rheostat of the turbogenerator, raising its voltage, and also cut in sections of resistance in the field rheostat of the motor-generator set, weakening its field and thus reducing its load.

P. M. Lincoln pointed out the great importance of the maximum demand in fixing the costs of energy from a hydroelectric plant. He praised the method of Mr. Tynes for reducing the peak.

J. L. Woodbridge suggested a comparison with the use of a storage battery, but did not find sufficient data given in the paper to do so. He suggested the advisability of using the steam turbine for more of the power than merely the peaks.

J. R. Bibbins discussed the length of duration of the peak which should be considered in determining maximum demand. The value of Mr. Tynes' apparatus depended largely upon the duration of the peak. In some cases demand charges are based upon peaks of one hour duration, and he questioned whether this was justifiable when a shorter peak limits the central-station output.

R. H. McLain told of a case where a large part of the central-station load was provided by coal docks and street cars. These docks are billed according to the instantaneous peak. As the number of peaks increased the load curve became more even. The charge might well have been based on a five-minute peak. The more central stations concede on this point, the greater the opportunities which will be opened for them.

In written discussion by E. D. Dreyfus it was suggested that the case presented by Mr. Tynes was hardly typical.

In closing, Mr. Tynes stated that the cost of steam was almost nothing, although occasionally live steam was used. Rates were based on the instantaneous peak.

William Oschmann then presented a paper entitled "Concatenated Induction Motors for Rolling-Mill Drive."

Concatenated Induction Motors for Rolling-Mill Drive.

The paper describes a six-speed concatenated induction-motor set for driving the finishing rolls of a 12-stand continuous mill. Analysis of the conditions in this mill showed that the use of a low-pressure turbine would lead to the waste of a large amount of exhaust steam and that the alternating-current turbine plant which was in operation had ample reserve capacity for driving the mill. The large number of speeds required suggested the use of a direct-current motor, but as this required a motor-generator set it was

found to be more expensive than the concatenated motor. An induction motor operating with a speed regulating set was also considered, but its disadvantages lay in the fact that a commutating motor or synchronous converter would be required, the performance of which at the frequency employed was questionable. The concatenated set installed consists of a double-wound main motor and single-wound secondary motor, both stators mounted on a common bed-plate and both rotors on a common shaft. The larger motor has both a 14- and 16-pole stator winding and the secondary motor has its winding arranged for four- and eight-pole connections. The control system is described in detail; its operation is very simple, so that no regular attendant is needed. The motor has six definite speeds and two additional resistance speeds, and while the control is somewhat complicated, it has been made so nearly fool-proof as to make a special attendant unnecessary. As a result of the year's operation there have been but three interruptions, the total loss of time due to which has been 68 minutes.

In opening the discussion Mr. Tschentscher pointed out the reliability of this set as evidenced by the loss of only one hour's time in operation; the rapidity and simplicity of control, and the satisfactory operation.

T. E. Tynes pointed out that the reliability of this unit was as great as that of a steam engine and that no spare unit was needed.

A. E. Averrett considered the concatenated type desirable where the range of speed was limited, as in this case. The power-factor, however, would be much lower where a greater speed reduction was required.

President Mailloux then spoke regarding the International Electrical Congress, which is to be held in San Francisco in 1915, and urged in its behalf the support of all electrical engineers.

W. A. Phillips, of the National Tube Company, then exhibited motion pictures which depicted the entire series of operations involved in the manufacture of pipe from the ore to the finished product.

Electric Strength of Air and Measurement of High Voltages.

The session on Wednesday morning was in charge of the Electrophysics Committee, of which J. B. Whitehead is chairman. President Mailloux called the session to order at 10:20 a. m., and Dr. Whitehead referred to the duty of electrical engineers in using the facilities at their own command to undertake in the cause of science physical investigations for which educational laboratories are not usually well equipped.

The three papers at this session were first presented and then all of them discussed together. The first was by F. W. Peek, Jr., and was entitled "The Sphere Gap as a Means of Measuring High Voltage." The second paper was by J. B. Whitehead and W S. Gorton and was entitled "The Electric Strength of Air." It was presented by Dr. Whitehead.

The third paper was by J. C. Clark and H. J. Ryan and was entitled "Sphere-Gap Discharge Voltages at High Frequencies." In the absence of the authors this paper was abstracted by Dr. Whitehead.

The Sphere Gap for Measuring High Voltage.

A gap method of measuring high voltage is desirable in certain tests because a gap measures the maximum point of the voltage wave. The needle gap is unreliable, and is subject to large corrections due to humidity, etc. The sphere gap is free from complicated corrections and the curve is subject to calculation. Wherever voltage is measured by a gap, correction must be made for air density—that is, altitude or barometric pressure, and temperature. The laws for this correction have been deduced for the sphere gap, from tests, over an air-density range equivalent to that from sea level to 18,000 feet elevation. An equation is given for calculating sphere spark-over curves for various spacings, radii, air density, etc. Standard measured curves for convenient sizes of spheres at sea level are given for practical use, as well as a table for applying these curves to any altitude. The altitude correction may be made very accurately. The complete standard curves should not be calculated when reliable measured curves are available. The effect of high frequency and impulse voltages are discussed. In making measurements certain precautions are necessary for accuracy, as well as for protection of apparatus. These precautions are discussed and test results are given.

The Electric Strength of Air.

The paper presents the account of an investigation of the influence of frequency on the corona, between 60 and 3,000 cycles per second. A wire and coaxial cylinder were used. A simple method for measuring the maximum value of an alternating voltage wave has been developed and used for obtaining this maximum value at the critical corona voltage. The gold-leaf electroscope was used to detect the first appearance of corona. It has been found that for frequencies above 275 cycles per second the corona voltage (maximum value) is not so uniform and constant as it is at frequencies in the neighborhood of 60 cycles. The indications of the investigation are that at 2,000 cycles the corona voltage is lower than it is at 60 cycles by about 3 or 4 per cent. The experiments reveal several interesting instances of resonance phenomena in the high-tension transformer circuits.

Sphere-Gap Discharge Voltages at High Frequencies.

The paper describes a series of experiments made by the authors to determine the values of steady high-frequency, high-voltage currents required to discharge between seven-inch copper spheres in air, at ordinary temperatures and barometric pressures. A 15-kilowatt arc generator was used as the source of high-frequency sustained high voltage, and the apparatus employed in securing and measuring currents of 123,000, 255,000 and 612,500 cycles is described in detail. The sphere-gap standard consisted of electrolytic copper spheres mounted on the ends of brass tubes in treated wooden frames, and the gap lengths were accurately determined by means of calipers and micrometer screw or steel scale.

The results obtained show a linear relation between sphere gaps and discharge voltage. The high-frequency voltages are almost uniformly 4.5 kilovolts below the 25-cycle voltages observed by Chubb and Fortescue. Needle gaps are not feasible for these conditions.

The discussion was opened by Paul M. Lincoln, who read written discussion submitted by L. W. Chubb. Mr. Chubb regarded the effect of temperature given in Mr. Peek's paper to be based upon the assumption rather than experiment. The formula given by Mr. Peek connecting voltage and length of gap agreed up to 320,000 volts with the results of his own experiments as well as with those of Mr. Peek. Above this voltage, however, the two did not agree and Mr. Chubb presented his own experimental results. Above the voltage mentioned, the air gap is unsteady and barometric influence seems to be greater than at lower voltages. With such high voltages there is a time element which influences the value of voltage required to break down a gap. He had been investigating the effect of light upon the discharge and found that the ordinary wave-lengths have little effect. When an air current was blown across the gap the results were more erratic. He regarded the precautions given in the paper to prevent oscillations of great importance. Referring to the paper by Messrs. Whitehead and Gorton, he discussed possible reasons for the effect of frequency and referred to the vibration of the wire as having some influence upon the results.

F. C. Caldwell referred to the effect of a resistance in series with the air gap in causing a drop of voltage in the case of high frequencies, where the charging current might have an appreciable value.

A. E. Waller presented written discussion by D. M. Mahood, who discussed the paper by Messrs. Ryan and Clark. This referred to the conditions of measurement and possible reasons were given for some of the results which had been obtained.

C. L. Fortescue disagreed with some of the assumptions that had been made by Mr. Peek and thought perhaps the issue had been clouded by the application of Mr. Peek's form of function to all cases. He thought the effects attributed to plates on the shanks supporting the spheres probably due to some other cause. He referred to the

effect of the charging current on the test results, especially where corona takes place, and also to the effect of ionization of the air. In the work of Messrs. Whitehead and Gorton he thought the mercury rectifier might have introduced surges which would cause error in the results. In his own work the use of a transformer ratio in measuring high voltages had been abandoned on account of resonance in the transformer circuit. The actual voltage might differ by as much as 60 per cent from the voltage given by the ratio of turns. Regarding the paper by Messrs. Clark and Ryan, he questioned whether the assumption of a sine wave was warranted, and since the spheres were isolated there was no definite point of earth potential in the apparatus.

D. D. Ewing discussed the deformation of wave due to a mercury rectifier and the use of a direct-current instrument to measure the rectifying current. If the permanent-magnet type of instrument were used, the average value of the fluctuating current might differ as much as 15 per cent from instrument reading. However, in the experiments of Messrs. Whitehead and Gorton, the conditions were probably such as to minimize this discrepancy.

E. E. F. Creighton referred to the lack of a suitable instrument for measuring high voltage. He had found the use of the turn ratio of a transformer out of the question at high frequencies. He spoke of the possible effect of corona on the lead wires upon the measured values. If the corona is steady there may be no trouble, but when it is unsteady it will introduce trouble. He described a new form of vacuum lightning arrester within which the ionization of the air had been found to persist, so that a second discharge requires less voltage than the first. This is with an air gap of about one millimeter. He considered Prof. Caldwell's point of resistance in the high-frequency gap circuit as very pertinent and the directions usually given for conducting air-gap tests are not suitable for lightning arresters. If the resistance in series is as much as even one-quarter ohm per volt the tests will be vitiated. He had found the effect of moisture in testing lightning arresters to be just the reverse of that given by Mr. Peek.

H. B. Dwight uttered a caution against the use of choke coils containing iron cores in test work, as they will sometimes cause trouble. He showed lantern slides for testing insualtors and explained how a high or a low voltage might be obtained in a circuit where such a choke coil is used according to the point in the voltage wave at which contact was made.

W. W. Lewis referred to the caution by Mr. Peek against the use of carbon resistances. He had found such a caution applicable to carbon resistances having high ratings where considerable earthy material had been mixed with the carbon. In low-resistance units, where pure carbon is used, there is no such trouble. He also referred to the expense involved in carrying out the direction of the mounting the spheres so that they are at a distance from the surrounding objects equal to twice the gap setting. He had tested the necessity for this and found that the presence of wood and porcelain objects had no effect upon the discharge when they were distant as much as half the gap length. On the other hand, metallic objects will reduce the spark voltage. He found that a metal disk on the shank of the sphere support might cause a difference as great as three per cent when the sphere was ungrounded.

E. P. Peck, J. R. Craighead and M. G. Lloyd asked questions and the discussion was then closed by the authors. Mr. Peek thought that he could explain the differences between the results obtained by Mr. Chubb and himself. The effect was probably due to oscillations in the circuit. He explained by means of a diagram how these oscillations could take place and why they would be of greater effect at higher voltages. He explained the difference in humidity effect in testing lightning arresters as due to the condensation of moisture upon them. Where a steady electromotive force is applied he had found initial ionization to have no effect upon the starting voltage. Where there is a single impulse, however, such ionization may lower the time required for breakdown and hence result in a breakdown which would not otherwise take place.

Dr. Whitehead summarized the results of the papers as indicating a slight lowering of voltage for a given gap at higher frequencies. This may possibly be due to errors, but he thought it a real effect. However, the paper by Messrs. Clark and Ryan dealing with excessively high frequencies should be further scrutinized and the results checked before final acceptance. He did not agree with Mr. Chubb as to the effect of ionization. He explained that the mercury rectifier in his experiments was not used to rectify but to act as a valve only. The results repeated so consistently that he did not believe there could be any varying disturbing effect in the circuit.

Dr. Whitehead closed the session by mentioning an experiment recently made by Prof. H. K. Onnes at Leiden, Holland, in which a coil consisting of 1,000 turns of lead wire was short-circuited and cooled by a bath of liquid helium to a temperature very close to the absolute zero. At this temperature the resistance is reduced to a negligible quantity, with a result that no energy is dissipated by the current circulating in such a coil. In this experiment an electromotive force was introduced in the coil by means of a magnet and the current was then found to continue flowing for several hours.

High-Tension Transmission-Line Data.

The session on Thursday morning was under the auspices of the Engineering Data Committee and after President Mailloux had called the meeting to order he turned it over to P. H. Thomas, chairman of that committee. Mr. Thomas presented the report of the Committee, giving data received from 25 power companies operating at 25,000 volts or higher, in reply to a list of questions which had been sent out by the Committee. He also submitted a proposed specification for inspection and tests of high-tension line insulators. After giving some explanation of the report and the matters which had led up to it, and referring to some of its especial features, the subject was thrown open to discussion.

John B. Fisken told of the deterioration which had recently been noticed in some of the solid copper conductors of the Washington Water Power Company, and he exhibited a sample of wire which had been in use at an elevation of 2,500 feet in territory where there is an annual rainfall of about 22 inches. This sample had been pitted and corroded upon the underside at the point where it was tied to the insulator.

Ernest V. Pannell stated that about 40 per cent of the high-tension transmission lines are now using aluminum conductors. Some of the others are now using conductors with steel cores and he would like to see a comparison of the use of different metals. The necessity of long spans has caused the introduction of the steel-cored cables. It was formerly thought that aluminum was suitable up to a span of 700 feet, but the experience of certain companies has shown that this is not the limit. Some alloys of aluminum have an ultimate tensile strength of 36,000 pounds per equare inch. If aluminum is compared with copper on the basis of the same conductivity there will be more sag and the towers must be stiffer, but if a larger cross-section of aluminum is used this is not the case. Referring to Mr. Fisken's sample, he thought that abrasion was indicated and he inquired whether aluminum wire had shown any similar results. In reply Mr. Fisken stated that his company had taken down 50 miles of aluminum after five years of use and found no such effect.

F. W. Peek, Jr., thought that the corrosion of Mr. Fisken's wire might be due to a brush discharge. Aluminum would not be attacked under the circumstances. It could be avoided by

coating the insulator with metal which would be connected to the line. He pointed out that there was an extra stress on the air due to the combination of two dielectrics in series.

Richard Fleming said that the deposit on Mr. Fisken's sample should be analyzed, as its composition might determine its cause. He thought the deposit looked like a carbonate but might be a nitrate. It was not likely that it was a sulphate.

M. von Recklinghausen pointed out that the copper was only attacked where the tie wire was connected to it. It might be due to friction, but this was not likely. A more probable explanation was electrolytic action, due to the slight difference in composition of the tie wire and line wire, and the presence of humidity.

D. D. Ewing suggested that as Mr. Fisken's sample is exposed in territory where the dry season lasts for two months and there is consequently much dust, the pitting might be due to the presence of sulphates, acetates, etc., in the soil, which would become deposited on the insulators and would cause corrosion as soon as it became wet from the rain.

S. C. Lindsay stated that the Puget Sound Traction, Light & Power Company had had encouraging results from the use of relays on its networks.

E. P. Peck gave some information regarding the telephone line of the Georgia Railway & Power Company, which had not been included in the report. This telephone line is run on the same towers as two 110,000-volt lines. It is about 12 feet below the power lines and between the two sets of conductors. The telephone lines occasionally break down from line and lightning disturbances. The use of lightning arresters has eliminated the trouble from another line operating at 22,000 volts. On the high-tension line, transformers are used which are insulated for 25,000 volts. The potential of a telephone line is normally about 5,000 volts above the ground. He gave a diagram of connections showing how the lightning arresters and insulating transformers were connected. The telephone lines break down on account of the voltage from line to line and not from line to ground. In answer to a question he stated that drainage coils were used. These discharge a current of about 3.5 amperes, which is nearly equally divided between the two lines. At present one of these drainage coils is installed at Atlanta but two others are to be added at other points along the line. The insulators for the telephone line are rated at 11,000 volts and they spill over when a power line comes in contact with a telephone line. The drainage coils do not interfere with talking.

P. H. Thomas discussed the matter of protecting telephone lines which run parallel to power lines. There are two principal points to be considered: (1) the difficulty of talking, and (2) protection to the operator. Interference with talking is due principally to electrostatic induction, although sometimes to electromagnetic induction also. The use of drainage coils will usually correct this. Such a coil consists of a transformer winding connected between the lines with the middle point grounded. Protection to the operator can be secured by using a one-to-one transformer insulated for 25,000 volts if it is supplemented by fuses, lightning arresters, etc., as the transformer protection alone is not sufficient.

E. E. F. Creighton referred to the vacuum lightning arrester used by Mr. Peck. This arrester was devised especially for the signal circuits of steam railroads and was designed to preclude the possibility of short-circuit. It will stand 1,000 amperes at 600 volts without short-circuiting and will open the circuit-breaker. It cannot carry the current for a long time, however, as there is no provision for dissipating the heat. The success with this apparatus on Mr. Peck's line was due to the fact that there were no continuous discharges lasting long enough to cause undue heat. For general use of this character, however, there is a better type of arrester. Referring to the corroded wire of Mr. Fisken, he thought there might be enough corona to produce nitrous oxide, which in conjunction with moisture in the air would corrode the wire. The conditions on Mr. Fisken's line would seem favorable for corona at the insulator.

R. E. Argersinger told of the use of the reverse-power relay on the system of the Pennsylvania Water & Power Company. In this system the switching is done entirely on the low-tension sides of the transformers at both ends. With the devices which are used at the substations (see page 1199, ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for June 13) satisfactory operation is maintained, as the devices take care of all trouble which occurs on the line and clear it. He considered it desirable to regard the transformer as a part of the line and not a part of the station and install controlling apparatus accordingly. He also told of another case of a 150-mile, 100,000-volt line which made use of the same scheme and had gotten fine protection by the use of reverse-current relays.

E. A. Lof pointed out that a ground on a delta-connected system increases the charging current and this is one thing which will militate against the use of the delta connection on higher voltages.

The discussion of the specifications for testing insulators was then opened, Chairman Thomas explaining the limitations which had to be observed in making the specifications fit present practice and present equipment of the insulator factories where the tests were of any value, as in practice trouble is not occasioned by rain. He suggested that a test for brittleness was desirable and would be glad to have a satisfactory one proposed. Personally, he favored a combined mechanical and electrical test, as given in the appendix to the specifications.

E. E. F. Creighton said that the committee represented the point of view of the buyer and he wished to present the point of view of the user. He explained the advantages of the use of an oscillation of Tesla transformer in testing insulators and gave the results of experiments showing that a great many insulators which would stand a test at 60 cycles broke down under a test at 200,000 cycles at the same voltage. Where insulators were first subjected to the high-frequency test and passed it, they never failed in a subsequent test at 60 cycles. This showed that the high-frequency test was a more severe test and the only question was as to whether it was a fair test. It could be made as severe as desired. When the same voltage is used it is a more severe test because the stress is applied to the insulator while the spill over is getting ready to take place. The older insulators, made when conditions of firing were not so good as they are now, often need to be tested in position and he described a set of apparatus for doing this.

Chairman Thomas referred to the heating effect of a high-frequency test, due to the fact that the heating is proportional to the frequency. As the dielectric strength decreases with rising temperature, this is undesirable. In practice insulators are subjected to impact and hence he considered the impact test preferable. Professor Creighton pointed out that this criticism of the high-frequency test was not just, since with the use of the oscillation transformer there is no appreciable heating. This is due to the fact that the application of voltage is intermittent and not continuous as it would be if supplied from a generator.

Edward Bennett favored the oscillation-transformer method to the impact test. If there were any appreciable heating it could easily be avoided by inserting a circuit-breaker in the primary circuit of the transformer. With the impact test mentioned in the specifications, one could not tell what was being applied. The oscillation method could be improved by connecting a condenser across the insulator.

E. M. Hewlett spoke of the need of a good absorption test and wanted to

know whether in its absence the manufacturer could not give a year's guarantee on insulators. Many insulators which are not thoroughly vitrified will nevertheless pass the initial test.

Farley Osgood said that a test of high-frequency was the most valuable one to which insulators can be subjected. His company made such tests regularly and found that many insulators which would stand a test at 60 cycles punctured on high-frequency. Even 33,000-volt insulators which would pass a test at 60 cycles would puncture upon a high-frequency test as specified for 13,000-volt insulators. This company is making use of a design having thicker petticoats but no change in the composition of the porcelain. Insulators that will puncture quickly are undesirable, as they should spill over first.

S. C. Lindsay stated that the impact test was not desirable, as an arcing ground upon a delta-connected system lasted longer and he therefore favored the elimination of the impact test.

John D. Fisken, speaking in regard to a rain test, stated that a stream from a fire hose had been directed upon a 60,000-volt line and no effect had been noted upon the insulators.

F. W. Peek, Jr., pointed out that "high-frequency" was used too loosely and that distinctions should be made as to just what is meant. The application of a steady high-frequency voltage might cause failure through heating. An oscillation transformer on the other hand may not have time to do the work necessary for breakdown. This is also true with the impact from lightning, but the effects of all three of these applications is different. There is also a question as to what voltage is applied to the insulator. Although an air gap may be connected in parallel, the insulator may for the fraction of a second be subjected to a much higher voltage than would normally break down the air gap.

W. B. Jackson inquired as to whether there was not an effective test for mechanical shock and also some method of making an eccelerated life test.

President Mailloux opened the afternoon session at 2:45 o'clock and called upon H. G. Stott, chairman of the Prime Movers Committee, to preside and to present a paper prepared by W. S. Gorsuch, R. J. S. Pigott, and himself, entitled "Present Status of Prime Movers."

Present Status of Prime Movers.

This paper shows in concise form the present status of heat engines and hydraulic turbines in commercial use today. The various types are compared as to capacity, efficiency, weight, cost and economy.

Reciprocating Steam Engine.—This has become obsolete in modern power stations but is still used in small plants where heating service is required. In small sizes it is slightly more economical than the small turbine. The superior reliability, low maintenance, sustained original economy and low attendance cost of the turbine overbalances the slight advantage in original economy of the small reciprocating engine.

Steam Turbine.—A table is given showing the water rate of a perfect Rankine-cycle engine for various pressures, superheat and vacuum. The efficiency increases with pressure, with superheat and with vacuum. The best water rates should occur at 75 to 85 per cent of the maximum 24-hour rating. Overload can be carried by means of extra nozzles, etc. Curves are given for thermal efficiency, steam consumption, weight and cost for different capacities of turbines. The turbine design is usually a compromise between cost of manufacture and efficiency.

Gas Engine.—In gas engines the efficiency increases with the load beyond the normal capacity of the engine and the rating is made as near as possible to the maximum capacity. There is hence little inherent capacity for overloads. The thermal efficiency remains fairly uniform for all ranges of size. Curves are given for efficiency, weight and cost, showing that big units weigh more per kilowatt than small units.

Oil Engine.—The oil engine also lacks inherent overload capacity and is restricted in size for the same reasons as gas engines. The largest unit in this country is 450 horsepower, and in Europe 2,500 horsepower. The thermal efficiency varies slightly with the capacity. Curves are given for efficiency, weight and cost. The fuel consumption of the best engines today in large sizes is about 0.4 pound per brake horsepower.

Hydraulic Turbines.—Recent designs have resulted in efficiencies over 90 per cent under the best conditions and the efficiency remains fairly constant through a considerable range. Curves are given showing the variation of efficiency with capacity and load. The cost is from $10 to $30 per kilowatt in large units; the lower the head the greater the unit cost.

A comparison between the different types is then given with reference to original cost and operating cost, curves being plotted for units of 750 kilowatts and multiple units for 20,000 kilowatts. There is also a comparison of thermal efficiencies, fuel consumption, maintenance, reliability and space economy. It is shown that the large steam turbine has now passed the gas engine in thermal efficiency, but is still excelled by the Diesel type, which has a maximum of about 28 per cent as compared to 24 per cent for the steam turbine.

Discussion was opened by R. Tschentscher, who referred to the use of gas engines using blast-furnace gas in steel mills and pointed out many places in the paper where the statements would not apply to this type of prime mover. These engines are now giving satisfactory service in steel mills and have been installed to a capacity of 175,000 kilowatts. Of these 140,000 kilowatts have been installed by the United States Steel Corporation, the individual plants running as high as 64,000 kilowatts. The cost for operation alone averages 0.275 cent per kilowatt-hour, with the units of the earlier type. Conditions are now better, single units as large as 3,000 kilowatts being used and the weight per kilowatt on these is lower than on the smaller size. The operating costs are also lower. The fixed charges (including 12 per cent for depreciation) vary with the load-factor, being 0.35 cent at 55 per cent and 0.225 cent at 75 per cent.

In comparing gas engines with steam turbines he thought different unit prices for fuel should be used, since producer gas can be made of coal of a very low grade. Regarding overload, this is limited by the generator, so that varying ability of the prime mover in this regard is unimportant. In the comparison at a capacity of 20,000 kilowatts there is no allowance for spare units, which allowance would be much less for gas and oil engines of small individual capacity than for steam turbines of 20,000 kilowatts. The comparison is consequently to the advantage of the latter. The cost of $140 per kilowatt for gas engines is too high; $85 to $100 would be better. As to reliability, gas engines are now good and they operate for 24 hours daily. He pointed out that the Ford Company is now putting in producer-gas engines combined with steam engines, the water for the latter being heated by the waste heat from the exhaust gas. He concluded that the paper presented much valuable information, but was misleading if the remainder of the plant be not considered.

J. R. Bibbins also commented upon many points and considered it necessary to include the auxiliaries to make a fair comparison. In the comparison at 20,000 killowatts capacity it was unfair to regard all the gas-engine units as running on reduced load, since in practice some units would be shut down and the others kept running at higher efficiency. Since most plants have a time of peak load there is no advantage in units that will run 24 hours continuously.

D. B. Rushmore pointed out that in the near future the gas turbine must be reckoned with as a prime mover. The selection of a prime mover depends on operating conditions, and the cost of the whole station must be considered, not merely one item in it. Reliability is the most important consideration, but capacity for instantaneous overload is also important. Actual operating efficiencies are not up to the values used in the authors' curves, which values cannot be maintained day in and day out. He questioned the suitability of such a paper in a meeting of electrical engineers.

The last statement called forth from C. O. Mailloux a defense of the appropriateness of the paper. He pointed out that the great development

in prime movers was due principally to electrical engineers. It is generally recognized that this field belongs to them and it has been placed in their hands in connection with the coming international engineering congresses. Thirty years ago no unit larger than 300 horsepower was to be found in any power station, and a consumption of 30 pounds of steam per horsepower-hour was considered good. Boilers were also in small units. The electrical engineer introduced precision in measurements in the dynamo room and is now invading the boiler room.

H. M. Hobart remarked upon the total investment per kilowatt for power houses and pointed out that a large fraction of this might be for land and buildings.

In closing the discussion Mr. Scott said that gas engines using blast-furnace gas had been expressly excluded from consideration since they were used in steel mills only.

Left Half.—Group of American Institute of Electrical Engineers at Bois Blanc Island, June 24.

The gas engines considered were assumed to use producer gas or natural gas. While it may be true that cheaper fuel can be used for gas engines than for steam turbines, it was not feasible to make a comparison except upon the basis of the same cost for fuel. The heat units used were a mean value between 32 and 212 degrees. It was only fair to the steam turbine to consider a unit of large capacity, such as is now in use and it could only be compared with multiples of other types of units. Entire plants had not been considered because the committee was only concerned with prime movers.

President Mailloux then resumed the chair and called upon W. I. Middleton to present a paper by Chester L. Dawes and himself entitled "Voltage Testing of Cables." Mr. Dawes supplemented the abstract with a few remarks.

Voltage Testing of Cables.

In this country rubber compound, paper, and cambric are generally used for cable insulation. From the formula given, the stress at any point in a homogeneous insulation may be determined. The minimum stress and the maximum allowable voltage occur when the conductor is 10/27 of the sheath diameter. The present irrational practice of testing cables should be standardized to conform to this formula or a modification of it. Over-stressing of the insulation is accompanied by a change of insulation resistance and electrostatic capacity. No one factor of safety is appliable to every cable system, but one must consider the conditions of operation as well. In testing the voltage may be applied: (1) by submersion; (2) between the conductor and metallic sheath; (3) between wires. The submersion test is the most severe. A sine wave is desirable for testing purposes, but rarely occurs in a commercial generator under these severe conditions of load. Reactance cannot always be used successfully to reduce the volt-ampere load on the generator. With a distorted wave an alternating-current voltmeter gives only a poor indication of the maximum voltage. The writers have devised an instrument based on the oscillograph principle, with which the maximum voltage may be determined, regardless of wave form. This was described in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, August 23, 1913.

William A. DelMar presented some written discussion which was read by Mr. Mailloux. He pointed out the distinction which should be made between the factor of safety and the factor of assurance. The latter should be the fixed quantity in all tests, although some prefer a test as near breakdown as possible. At low voltages a greater thickness of insulation is used for mechanical reason than would be given by a computation of dielectric strength.

C. O. Mailloux called attention to a third method of cable manufacture, in addition to the two given in the paper. This consists in wrapping the conductor with paper which has been saturated with insulating compound. He explained the advantages and disadvantages of this method.

H. G. Stott pointed out that cables of large capacity require thicker insulation than smaller cables for the same voltage, for mechanical reasons. He did not believe in the idea that insulation was overstressed in testing. His company at least once a year applied 2.5 times working voltage to all cables and in 15 years these had shown no depreciation.

C. L. Fortescue advocated the measurement of maximum voltage by applying the voltage to a condenser and measuring the average charging current. The use of a transformer for this purpose is not reliable. Even with a sine-wave generator there may be distortion. Answering a question by E. E. F. Creighton, he said that long cables break down more easily than short pieces on account of the distributed capacity, which causes a higher voltage at the remote end.

P. H. Thomas referred to the heating effect, which increases in proportion to the frequency. He thought the result with long and short cables would be different if a generator of large capacity were used.

J. R. Craighead pointed out that a generator giving a sine-wave was desirable, but it was very difficult to get one especially with a capacity load. Such a wave form may be obtained from any line voltage by adjusting a reactance to suit the capacity, and thus obtaining tuning for the frequency used. The use of the oscillograph for measuring maximum values was suggested two years ago in a paper by Robinson and Ball.

Mr. Middleton stated that a short period of test was recommended in order to avoid heating This could never be of importance where the cable is submerged in water under any circumstances.

Mr. Dawes agreed that the voltage may pile up at the end of the cable on account of inductance when it is in the form of a coil, but not when it is in position in use. Mr. Craighead's method for sine wave is not suitable for factory use, where the operators are unskilled.

Presentation of Edison Medal.

On Thursday evening a session was held for the presentation of the Edison medal to Charles F. Brush. President Mailloux called the session to order and made the presentation speech, in

which he referred to the early developments of the electrical industry. Soon after the work of Pacinotti and Gramme became known in this country, Mr. Brush constructed models of similar machines and set to work to improve them. He secured patents on his inventions about 1877 and these laid the foundation for electric lighting. His work was so thorough that it left little for others to do. In 1878 Dr. Mailloux had seen his exhibition in Boston of an arc-light machine with a capacity for supplying four lamps. The invention of the differential arc-lamp was the greatest step in the application of electric lighting, as this permitted the operation of arc-lamps in series. In connection with this, the automatic cut-out was invented. The speaker pointed out how the thorough technical education of Mr. Brush had enabled him to build up his system upon engineering lines and sound mechanical principles. His apparatus was so mechanically good and yet simple that it held the field for years. The elements above mentioned along with the automatic regulation of the dynamo constituted a system of electric lighting which was rapidly introduced for many purposes and especially for street lightning. By 1880 the art and the industry had been introduced both here and abroad and many hundreds of arc-lighting installations had been made at the time the first Edison central station was started in New York in 1882 for incandescent lighting. The rivalry between the Edison and Brush systems in these early days was intense and one would never expect to see the two names linked together, but upon this occasion it had come about and the medal which bore the name of Mr. Edison was to be presented to Dr. Brush and today we recognize that they are both great men. He referred also to other work of Dr. Brush, such as the invention of the compound-wound field and his early patents upon secondary batteries. He then made formal presentation of the medal and the accompanying diploma to Dr. Brush, who responded briefly in appreciation of this honor.

In the absence of Past-Presidents Gano Dunn and Ralph D. Mershon, the past-president's badges, which were to be presented to them were turned over to Secretary Hutchinson for delivery.

Farley Osgood then presented, upon behalf of the Board of Directors, a past-president's badge to Dr. Mailloux.

President-elect Paul M. Lincoln was then introduced and made a brief speech asking for the co-operation of the entire membership in making his administration a success.

The meeting then adjourned to the grill room in the basement of the hotel, where L. T. Robinson presented the various prizes which had been awarded for athletic and other events during the convention, and a cabaret entertainment was provided.

President Mailloux called the Friday morning session to order at 10:15 o'clock. The first paper to be presented was one by M. von Recklinghausen, entitled "Sterilization of Water by Ultra-Violet Rays." This was illustrated with lantern slides and diagrams.

Group of American Institute of Electrical Engineers at Bois Blanc, June 24.—Right Half.

Sterilization of Water by Ultra-Violet Rays.

The only industrially applied source of ultra-violet light is the mercury-vapor quartz lamp. The spectrum emitted by this lamp and its variation in temperature have been studied and the results of this study are given. The activity of the light may be measured in various ways, based upon its energy, its ionizing properties, the chemical actions produced and its bactericidal action. The latter is the most suitable for the present purpose. The ultra-violet radiation increases with the temperature but as the quartz lamp becomes opaque if operated at too high a temperature, it is necessary to limit the wattage to that which would be used for illuminating purposes. Different forms of sterilizing apparatus are described, including a so-called pistol lamp which permits all the light to be utilized in the water. It is desirable to first filter the water and not to let it come in direct contact with the lamp on account of its cooling effect. Different germs have different sensibilities to ultra-violet radiation and a chart is given showing the relative times of exposure necessary. It is desirable to expose the water to the rays several times in passing through the apparatus. Typical installations for the general supply of Luneville, France, and for a swimming pool in New York City are described. The smallest lamp used operates at 110 volts, 2 amperes. The largest so far made is for 500 volts, 2.5 amperes, and as many as ten of the latter have been used in one apparatus. The energy consumption is from 50 to 130 kilowatt-hours per million gallons of water. Many installations have been made in Europe and are operating successfully.

The discussion was opened by Morgan Brooks, who pointed out that with a source of light which constituted a line rather than a point, the variation with distance would be more nearly inversely rather than inversely as the square.

Theodore A. Leisen, of the Detroit City Water Department, inquired as to the effect of turbidity and color of the water; whether it can be used without filtration and what effect it has on current consumption. In Detroit the turbidity is low and filtration is unnecessary for clarification. The method proposed will have to compete with the use of such chemicals as calcium hypochlorite. There are objections to putting chemicals into drinking water, as if used in large quantities they may give a taste or odor. They will, however, destroy bacteria, but the electrical method is preferable from the esthetic point of view and most cities would be willing to spend a little more for it if necessary.

William B. Jackson pointed out that this method must also compete with the ozone method. He inquired as to the relative cost of that method and as to the mechanism by which the germs are killed.

Dr. von Recklinghausen, in closing the discussion, said that the effect of turbidity depended upon the size of the particles and their constitution. If the particles are larger than the microbes they may shield the latter, while if smaller, like a color in solution, they may absorb the rays, but will not shield the microbes. In the latter case it is possible to work with a turbidity of 20 parts in a mil-

lion, but at a reduced rate. If turbidity is due to sewer effluence, the particles themselves are infected and the water could not be sterilized by this method. The chemical method is probably cheaper unless the cost of an expert chemist is included and this is practically necessary in following up the treatment. Filtration in this country is usually very effective and a consumption of 30 kilowatt-hours per million gallons of water would probably be sufficient, while 50 kilowatt-hours would give a margin of safety. At one cent per kilowatt-hour, 30 cents per million gallons would be a sufficient expenditure for current; allowing 30 cents for renewals, etc., would make a total of 60 cents. This is small in comparison to the cost of water supply without treatment.

Referring to ozone, he stated that difficulties are encountered in its generation, as sometimes other materials, such as nitrous acid, are produced; the results at St. Petersburg have been discouraging. At one town in Switzerland there has been a six months' test, using the two methods alternately. The consumption of current is about the same for an ozonizer as for the mercury lamp, but the ozone apparatus requires auxiliary apparatus and expert attendance. The original cost of installation is about 2.5 times as great. All methods need water which is physically good (filtered) or a larger quantity of the sterilizing agent is necessary.

The effect of ultra-violet rays upon the microbe is not due to heat. It also appears not to be due to the formation of any chemical. After a long exposure the germ plasma appears to be coagulated, but this is not apparent after an exposure short enough to just kill the germ. At a distance of two centimeters 0.05 second is sufficient for this purpose and very little energy is involved. The microbes are permanently killed and not merely rendered inactive. He thought there was probably an action on some internal ferment.

At this point Secretary Hutchinson presented some resolutions of thanks to the various companies and persons in Detroit who had extended courtesies to the Institute, which had been passed by the Board of Directors. The meeting unanimously voted a hearty endorsement.

Frank F. Fowle, chairman of the Telegraphy and Telephony Committee, was then called to the chair and a paper was presented by Carl Kinsley, entitled "A High-Speed Printing Telegraph System."

A High-Speed Printing Telegraph System.

The paper describes a system of high-speed printing telegraphy devised by the author, a prominent feature of which is the simplicity of the apparatus and its operation. The author briefly mentions a number of high-speed systems which have been tested by the operating companies, none of which have completely fulfilled all the requirements for accuracy, rapidity and low cost which are desirable for commercial work. The system described is operated in connection with a commercial typewriter to which a punch is connected which perforates a half-inch strip of paper with groups of holes distinctly spaced in five rows, each group representing a letter. The punched strip of paper is then sent through the transmitter so that the holes pass under five wire brushes. Batteries of either polarity are thus connected between the earth and either one of a pair of conductors, or batteries of different potential can also be used. At the receiver there are five elements which are separately controlled and these elements make an autographic record by means of a local battery on a moving sensitized paper whenever they touch the surface. The apparatus, which is comparatively simple, is illustrated and described in detail. The operating speed is 650 words per minute over a 375-mile line.

The discussion was opened by C. R. Underhill, who complimented the author upon having produced the simplest form of high-speed printer which he had seen. Its only handicap was that two line wires were needed. He appreciated the difficulties involved, as he had himself brought out a printing system in 1904, which printed English letters which were sent by the Morse code. The spaced letters in this code made a difficulty and it was much easier to use the Continental code. He pointed out that the latter was used abroad and also by wireless operators in this country, and commented upon the fact that the telegraph companies avoided its use.

Ralph W. Pope spoke in appreciation of the ingenuity of this system. He referred to earlier systems and pointed out the advantage of a page printer over a tape printer. He thought it would be desirable to use a sixth element to increase the legibility of the figures. The cost of telegraph messages is a small item to all except large business houses. Good service is more important than low cost. He mentioned many other interesting points regarding present telegraph practice.

George S. Macomber regarded the method as a very happy combination of inventions which had been previously used separately, and gave historical references to some of these.

In closing Prof. Kinsley pointed out that leakage had no effect in this system unless it reduced the current below the minimum required for operation. It differed from quadruplex in this particular. He preferred five elements to six, although it is true that six give greater legibility. Four elements can be used if desired, but the letter shapes are not so distinctive. The number of current impulses varies with different letters. With a possibility of 12 impulses in the time alloted to a letter there may actually be only three or four.

Frank F. Fowle then presented a paper entitled "Toll Telephone Traffic," President-elect Lincoln occupying the chair.

Toll Telephone Traffic.

Experiments are described to determine the relationship between telephone circuit loads and the corresponding delay to traffic. The operating methods employed and the number of circuits available determine in general the number of messages per day which can be handled over a single toll circuit. The average delay to traffic obviously depends upon the number of messages per circuit per day, or the circuit loads. With a given load-factor, increase in the circuit loads will increase the average delay to traffic. At the same time the revenue per circuit-mile will correspondingly increase. The practical limit, however, is approached when the delays to traffic reach a point where the service is unsatisfactory. The results of the experiments described illustrate the fact that increasing circuit loads increase the delay to traffic, and vice versa. The revenue per circuit-mile is directly proportional to the product of the circuit load and the toll rate per minute-mile; consequently the relationship between the quality of service and the toll rate is generally obvious, assuming a certain rate of return on the plant investment.

The only discussion was presented by J. L. Wayne, who pointed out that the paper emphasized that speed costs money. The tables show that the slowest time is about 2.5 times as long as the average delay, the variation being due to the variation in load during the day. This delay is necessary to avoid excessive cost. Each user of a telephone thinks that his message is the most important, and it would be well if the ideas brought out in this paper could be widely disseminated.

The convention then adjourned.

The Section delegates met together each day at luncheon for informal discussion, and on Friday afternoon held a formal conference under the direction of P. M. Lincoln, chairman of the Sections Committee.

The total registration at the convention was 459.

Entertainment.

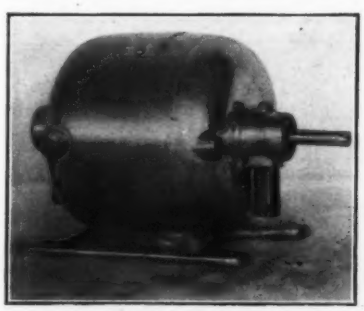
The convention opened with a reception and dance in the Hotel Pontchartrain on Monday evening. On Tuesday afternoon automobiles were provided and sight-seeing trips were taken through Detroit. On Tuesday evening there was a card party for the ladies and on Thursday afternoon there was a putting contest for them. On Wednesday afternoon a steamboat trip was taken down the river to Bois Blanc Island, where baseball and other sports were indulged in and supper was served. The return was made in the evening, with dancing upon the steamer.

Golf and tennis tournaments were held during the convention, the grounds of the Detroit Golf Club and the Detroit Tennis Club being at the disposal of the delegates.

New Electrical and Mechanical Appliances

A New Line of Small Motors.

The smallest of a new line of power motors manufactured by the Diehl Manufacturing Company, of Elizabeth, N. J., is shown in the accompanying illustration. This motor is constructed with a one-piece die-cast shell and detachable end cover, also die-cast. Metal screw brush-holder caps, all-metal oil cups inserted in the under side of the bearing, and substantial die-cast feet extending beyond the length of the body, but well within the overall reach of the bearing housings add to the general appearance and stability of the outfit. The frame is without angles or projections and has all the "fit in" qualities demanded of small motors. The field frames are composed of laminations which contribute to efficiency and current economy. This small motor is built for general power usage and is furnished



New Diehl Small Motor.

with or without feet, as specified, in a variety of finishes, and is rated one-twentieth horsepower, series-wound direct current or one-thirtieth horsepower alternating current; in either case the speed is 2,500 revolutions per minute.

Automatic Time-Limit Cutout.

There has been a demand for a time-limit cutout by means of which a circuit when closed at any time is automatically broken after a predetermined and limited time interval. A device to meet these requirements has recently been developed by the Independent Electric Manufacturing Company, of Milwaukee, Wis.

One form of this apparatus is illustrated herewith. It consists in general of a train of gears with an escapement mechanism, two electromagnets and a small circuit-breaker. The latter is shown in the upper left-hand corner of the device just over the gear train and escapement. The two magnets are at the right.

The circuit-breaker shown is a small toggle switch operated by a spring, giving quick break. After the breaker is automatically opened, it is reset by hand by means of a lever outside of the case, but not shown in the illustration. In another form of the apparatus to be used in connection with a remote-control switch, the circuit-breaker would be replaced by relay contacts.

The lower magnet acts in the same manner as the magnet of a self-winding clock. When energized, this magnet compresses a spring which by means of a ratchet and pawl acting on the gear train sets the latter in motion. When the spring after an interval has unwound or returned to its original position, the magnet again operates, thus keeping the gear train in motion as long as the current supply to the magnet is not again interrupted.

The upper magnet governs the tripping device for the circuit-breaker and controls the circuit to the lower magnet coil. When this magnet is energized, it causes the pawl to engage a ratchet on the last gear of the gear train, and by means of an arm connected with the pawl to open the circuit-breaker after a definite interval of time has elapsed. When the magnet is energized it also closes the circuit to the lower magnet coil and keeps the gear train in motion. If the current supply is interrupted for any reason, the magnet armature will drop and allow the tripping pawl to return to its original position.

From the above it will be clear that if the current remains on the upper magnet coil continuously for a predetermined length of time, the tripping pawl will finally open the circuit-breaker, but if the current is interrupted before this period is ended, the circuit-breaker will not be opened and the apparatus will automatically reset itself. An intermittent current, or a current not sufficiently strong to operate the magnet armature will, therefore, never open the small circuit-breaker.

The apparatus may be used for a variety of purposes, among them may be mentioned the following:

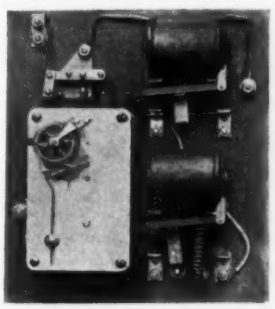
It may be used as an overload relay in connection with a remote-control switch or circuit-breaker to open the circuit if the overload continues for a definite predetermined length of time.

It may be used in connection with a remote-control switch to control hall lights or other lights, needed intermittently for short periods of time. When the lights are needed, they would be turned on by hand and then after a certain period, would be automatically turned off by the apparatus.

The apparatus may be used to control lamps used for blue-printing in the same manner as above.

It can control electric cooking operations, and can be set to open the circuit to an oven, for instance.

It may be also used where it is desired to open a circuit if the current supply is continuous, but leave it unaffected if the current supply is intermittent.



Automatic Time-Limit Cutout.

The apparatus illustrated may be set for a time interval of from one-half minute to fourteen minutes, and can be readily modified to give a much longer interval when necessary.

This apparatus is substantially built in all respects and all relay contacts are provided with platinum tips. A removable metal cover is provided and the apparatus occupies a space of approximately 10 by 11 by 4 inches. All electrical connections are simple and easily made.

Copper Exports.

Exports of copper for the week ending June 25 were 8,695 tons; since June 1, 29,388 tons; same period last year, 25,341 tons.

Enameled Conduit with Clean Threads.

The Enameled Metals Company, of Pittsburgh, Pa., has developed a feature in the manufacture of its enameled pipe that constitutes one of the most significant advances for the benefit of the electrical contractor.

While the conduit made by this company is going through the process of enameling, the pipe is protected by a strawboard nipple which allows the pipe to be thoroughly enameled both inside and outside, and eliminates the deposit of enamel upon the threads.

As may be seen from the accompanying illustrations, the method of removing the strawboard nipple and making available the bright, clean threads is one of the utmost simplicity. All that is necessary is for the mechanic to make an incision into the strawboard and peel away the paper covering.

The conduit is delivered in 10-foot lengths with the strawboard nipple on the one end and where the pipe nipple is placed on the other end the threads of the nipple are protected with the strawboard covering in the same way. The company announces that all "Pittsburgh Standard" conduit will hereafter be available with the protective feature, which it claims will do away entirely with the necessity of cleaning the threads and greatly facilitate the installation of conduit work.

Fig. 1.

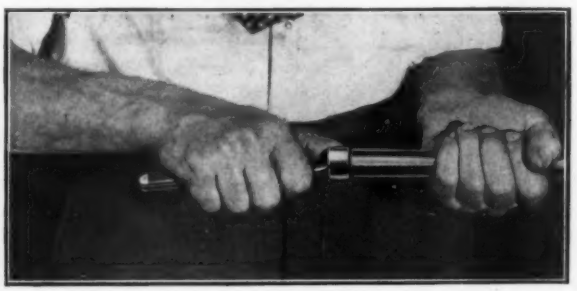


Fig. 2.

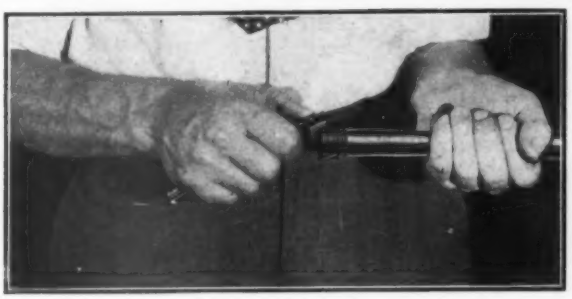


Fig. 3.

Fig. 4.

Removing Protection from Conduit Threads.

The Canadian Niagara Power Company has been notified by the Canadian Government that its exportation of power to the United States must at no time exceed 50,000 kilowatts.

Tractor Trucks and Additional Locomotives for Butte, Anaconda & Pacific.

The Butte, Anaconda & Pacific Railway Company has recently ordered from the General Electric Company four additional freight locomotives which will be duplicates of the 17 80-ton units put in service about a year ago and already described in these columns. In order to make these locomotives suitable for very slow-speed spotting service, there have also been ordered three additional tractor trucks which can be used in combination with the standard locomotive units. These trucks are an ingenious adaptation of standard parts of the freight locomotives, increasing the tractive effort of the standard unit to the equivalent of a 120-ton locomotive. These units will be used especially for spotting cars at the smelter and also for low-speed switching in the Butte yards.

While the new locomotives are adapted especially to switching service, they are also capable of operation in combination with any of the freight locomotives now in service, and have the same electrical and mechanical equipment.

During the present year it is expected that approximately 25 per cent more ore will be transported from Butte to Anaconda than was hauled last year. This increase arises from the transfer of ore which was previously hauled to smelters at Great Falls. The additional haulage will bring the total annual traffic on the road up to about six and one-quarter million tons.

The three two-axle tractor trucks will each be equipped with two GE-229 motors insulated for 2,400 volts similar to those on the locomotive. Cable and connecting plugs will also be provided for operation with the locomotives, so that the truck motors will be operated with the other motors from the same controller without change in the main control. The number of stops will therefore be the same as on the locomotive, ten points with six motors in series and seven with two sets in multiple, each set consisting of three motors arranged in series. In operation, each of the tractor truck motors is connected in series with one pair of motors on the locomotive, making a six-axle, six-motor unit which will furnish 50 per cent more tractive effort than the 80-ton locomotive alone at about two-thirds speed without increase in the current input.

Mechanically these trucks are similar in construction to the trucks on the 80-ton locomotives. Instead of a locomotive body, however, a platform is supplied, built up of channels, angles, and plates which are supported on the truck transom. Struts are provided at the corners to secure the platform to the side frame. Ballast, consisting of cement and iron punchings of sufficient quantity to bring up the weight of the truck to 40 tons, is placed between the center channels of the platform in a boxlike structure built for this purpose. A passageway protected by a handrail extends along each side of the platform.

In the center of the platform there is a crane which extends to an angle from the platform floor, suitable for

supporting the eight cables necessary for connecting the motors of the tractor to those on the locomotive. This crane can be revolved 180 degrees so as to permit the coupling of the locomotive to either end of the truck. When in operation, this crane is rigidly locked in position. Air-brake equipment with the necessary triple valve, auxiliary reservoir, etc., is also installed on the truck.

Each of the four locomotives now under construction is provided with a junction box placed near the roof above the front window. This is designed so as to permit the removal of couplers with a small amount of labor and time, so that the truck may be connected to any one of the freight locomotives which is provided with this junction box.

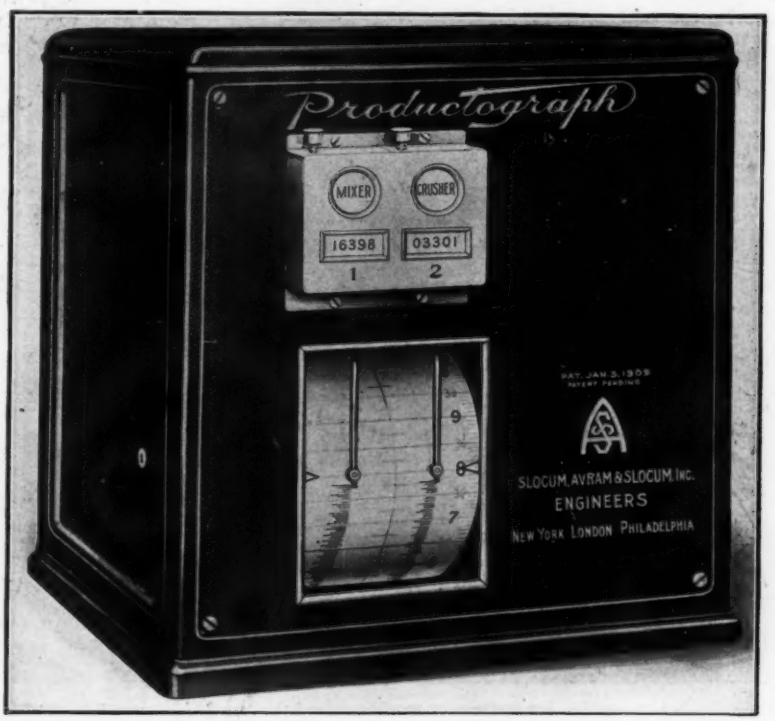
The Productograph for Showing Machine Records.

The engineering firm of Slocum, Avram & Slocum, Incorporated, 30 Church Street, New York City, found it a very difficult matter to get accurate reports and data on the operations of machinery in such plants for which its services were engaged as production engineer. Reports from human sources were found unreliable and in some instances greatly colored because of the negligence of foremen and department heads. The firm therefore invented, for its own use, an automatic device which, placed in the office of the plant owner or manager, and thence wired into the plant, will give an absolutely true and constant record of all machinery operations.

Briefly summarized, the device will do the following things: show the exact starting and stopping time of machinery; the stops during the day and their duration; the speed and its variations due to change of load from time to time during the day; finally count the output of whatever kind it may be.

One of the great troubles in American industries is lost time on machinery. This condition seems to have grown into a habit and doubtless was the outcome of the very rapid growth of manufacturing plants. A well known public economist asserted recently that the average American plant does not run at an efficiency of more than 60 per cent. Subsequent government statistics, gathered from various sources, confirmed the fact. Conditions such as these are revealed by the Productograph charts and in consequence they can be corrected almost immediately. A history of the installations so far made by this firm shows an average increase of 35 to 45 per cent in production.

As especially applied to machine tools the makers made a recent installation of the Productograph in a very large plant at Bridgeport, Conn., where it was subject to most rigid tests under a time-study process on certain work on a vertical turret lathe. The charts made by the instrument were sent to the firm's office for interpretation and they showed that time studies made with stop watch at the same time the records were made on the Productograph were wrong, and the records correct. The production experts showed the depth of cut being taken as 11 thousandths, whereas the Productograph charts showed the depth of cut as 107 ten-thousandths. The latter was found absolutely true. It was further shown that the chuck speed was 28 revolutions per minute when the stop watch studies showed it as 23 revolutions per minute. The subsequent speedometer test proved the Productograph record absolutely accurate and that the machine was running 25 per cent faster than the production showed.



Instrument for Taking Machine Production Records.

The Productograph is a very unique device. The owners claim that it can be located in Washington and connected to the Panama Canal, showing at the Capitol in Washington the time of opening and closing of the locks for passage of ships. A large railroad company is considering its application to dangerous crossings to make a permanent record of the exact time of lowering and raising of gates and the ringing of bell, while simultaneously recording the exact time of the train's passage over the crossing. The advantages of such a record are obvious in case of subsequent litigation following a casualty. The device merits investigation by any manufacturer.

The mechanism of the Productograph is exceedingly simple but strong and is constructed and designed to stand up and work under the most severe conditions. It consists of magnets which, when energized, attract needles that draw lines on the revolving chart, as shown in the illustration herewith. At the same time the magnets actuate counters which record the number of lines drawn. Every tenth line on the chart, or multiple thereof, is shown by a line a little longer than the rest. This greatly facilitates matters if the production of a machine, between any two limits, is desired.

The needle points are made of German silver, while the chart is of lead paper. The line drawn is very distinct and cannot be easily erased. This is a most important point, as most recording instruments have ink pens which require constant refilling and much attention.

Welland-Niagara Power Development Proposed by Canada.

The Canadian press states that the Ontario Hydro-Electric Commission plans to utilize the waste waters of the new Welland Ship Canal for power development on the Niagara, conveying the canal waters to the Whirlpool, where a generating station will be constructed. Chief Engineer F. A. Gaby, of the Commission, has started a survey. The Commission is empowered by the Dominion Government to utilize all the waste waters of the canal excepting a small amount permitted to the Niagara-Welland Power Company.

The Government plans to generate between 190,000 and 290,000 horsepower at the Whirlpool. The development will, it is said, involve an expenditure of more than $2,000,000.

An Electric-Vehicle Battery-Charging Outfit That Helps to Keep Costs.

During the current year the Curtis Publishing Company, Philadelphia, Pa., publisher of the *Saturday Evening Post, Ladies' Home Journal* and *Country Gentleman*, built a garage for its electric delivery wagons and trucks, and equipped it throughout in the most modern manner.

One of the most interesting features of the equipment is the battery-charging outfit, a striking point of advantage of which is the arrangement made to keep exact records of the energy used by the different cars.

Fig. 1 shows the machine part of the outfit. Alternating current is received from the lines of the Philadelphia Electric Company, and is transformed into direct current by a motor-generator set. The generator of this set is so designed that its voltage can be adjusted to approximately that required for the batteries being charged, so that little energy is wasted in the resistors.

Fig. 2 shows the switchboard, the resistors being mounted on the rear. It will be noted that this board is sectional. On the right is a large panel, which controls the motor-generator set. This panel is equipped with a generator circuit-breaker, switch, ammeter, voltmeter, field rheostat and (at the bottom) a reverse-current relay, which opens the circuit-breaker should the direct-current voltage fall below the voltage of the batteries being charged. A line voltmeter and circuit-breaker for the alternating-current circuit are also mounted on this panel.

On the left are two series of sections which control the charging circuits to the car batteries. Each section controls two circuits and each of the twelve circuits is assigned to a single car, a small name-plate being provided to designate the circuit. It is evident that, if more cars are purchased, additional sections can be added to the board as desired. Each circuit is provided with the proper resistance to suit its special car and can be used independently. Hence, any or all of the cars can be charged at the same time.

At the top of each vertical row of sections is an ammeter and voltmeter. These instruments are so connected with the charging line that the operator at the switchboard can tell precisely the condition of charge of the car batteries on any individual circuit at all times and does not have to depend on the often-damaged car instruments. In fact, aside from connecting and removing the charging plugs, which are connected to lines running into the garage, the operator performs all operations at the switchboard.

Integrating watt-hour meters are mounted on the charging sections. They have two scales—one, which is set to zero for each charge, showing the amount of each separate charge, and the other showing the total amount of energy used by the car from a given date. Thus, an exact record of the energy consumed by each car can be obtained for any desired period, and one of the important elements of cost of operation for each car can be exactly determined.

Fuses to protect the battery from overload and a resistance-adjusting rheostat are in each circuit.

This outfit possesses the following advantages: All the charging apparatus is compactly mounted in a very small space. Full protection is afforded to the power and battery circuits, and accurate meters inform the operator of conditions at all times. Every operation can be performed from the front of the board. Exact information as to the energy consumption of each car for various periods can be obtained. Extensions can be made to the outfit as the fleet of cars increases.

The entire equipment was supplied by the Westinghouse Electric & Manufacturing Company.

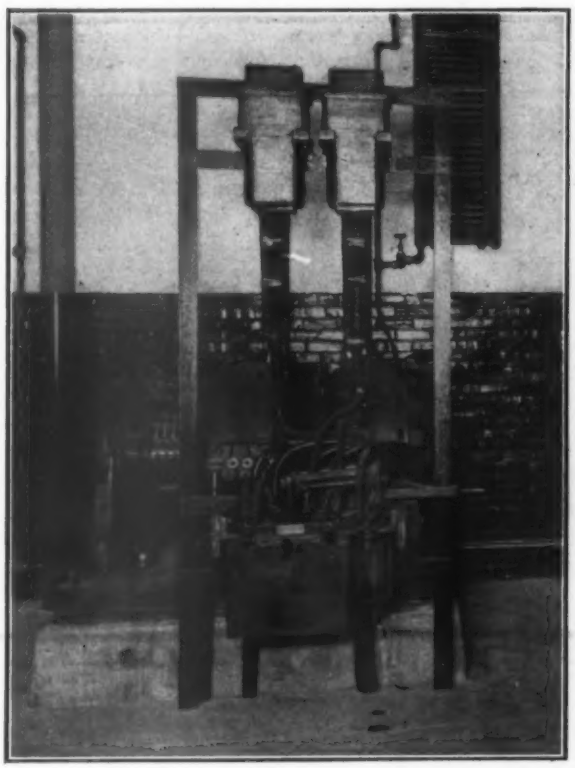


Fig. 1.—Motor-Generator Battery-Charging Set.

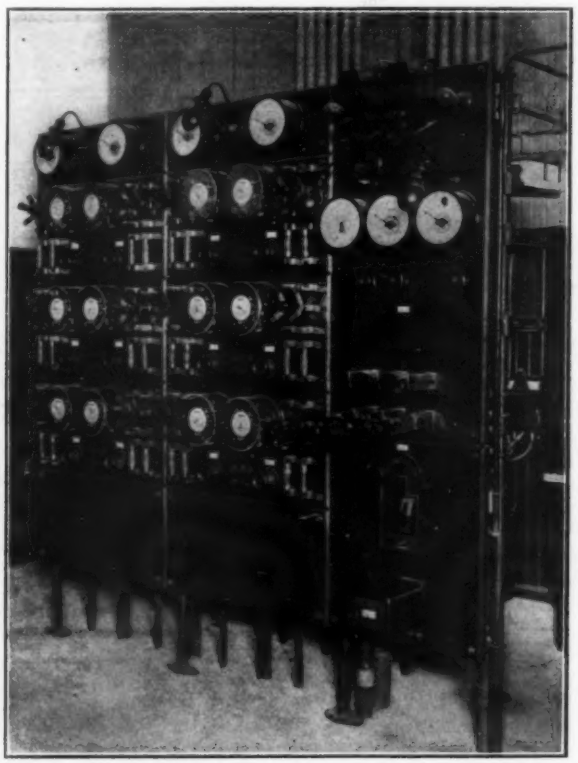


Fig. 2.—Record-Keeping and Control Switchboard.

Latest Approved Fittings

The electrical fittings illustrated and described in this department have been approved by the Underwriters' Laboratories, Incorporated, following examination and tests conducted under standards of the National Electrical Code as recommended by the National Fire Protection Association.

CABINETS.—The Cleveland Switchboard Company, 430 Prospect Avenue, Northwest, Cleveland, O.

Cabinets shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with requirements of the National Board of Fire Underwriters and examined at factories and passed by Underwriters' Laboratories, have labels attached.

Approved May 13, 1914.

CABINETS.—The Koschin Company, 269 Clinton Street, Milwaukee, Wis.

Commercial products of this class which are regularly examined and tested under the supervision of Underwriters' Laboratories at the factories where they are produced, bear uniform labels by which they can be identified in the field.

Approved May 22, 1914.

CABINETS.—United Electric Manufacturing Company, 926-940 Lafayette Street, New Orleans, La.

Cabinets shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with requirements of the National Board of Fire Underwriters and examined at factories and passed by Underwriters' Laboratories, have labels attached.

Approved May 18, 1914.

CIRCUIT-BREAKERS.—The Cutler-Hammer Manufacturing Company, Milwaukee, Wis.

"C-H," 125, 250, and 550 volts, 34 to 525 amperes.

Types A-1, A-2, C-1, D-1.

Approved June 3, 1914.

CONDUIT, Flexible Steel.—Penn Yan Cable Company, Penn Yan, N. Y.

Conduit shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with requirements of the National Board of Fire Underwriters, has label attached to each length.

Approved May 23, 1914.

CONDUIT BOXES, Supports for.—Alex. M. Knauber & Company, 742 South Euclid Avenue, Oak Park, Ill.

Formed strap-iron supports designed for the mounting of outlet boxes in hollow walls and ceilings. The supports are perforated with numerous oblong holes for convenience in fastening them to studs and joists and for the convenient adjustment of the various outlet boxes.

Approved June 1, 1914.

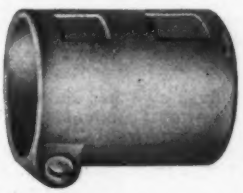
CONDUIT BOXES.—The Adapti Manufacturing Company, Winter and Leonard Streets, Cleveland, O.

"Adaptiboxes," for use with rigid conduit of sizes 1.5 to 4 inches inclusive.

Outlet boxes, types 2,900, 3,000, 3,100, 3,200, 3,300, 3,400, 3,500, 3,600, 3,700, 3,800, 3,900, 4,000, 4,100, 4,200, 4,300.

For use in concrete construction only, catalog Nos. 4C-o, 5C-o.

Box extension, catalog No. 550.



Conduit Coupling.—National Metal Molding Company.

Service entrance fittings, types 2,700, 2,800, 4,500.

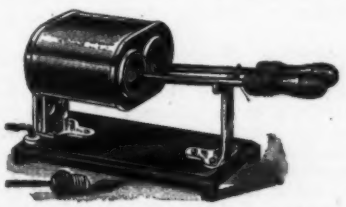
Approvel May 22, 1914.

CONDUIT OUTLET BUSHINGS, COUPLINGS AND FITTINGS.—National Metal Molding Company, Fulton Building, Pittsburgh, Pa.

"National" box connector made of malleable iron sherardized; for use with armored cable and flexible conduit, catalog Nos. 2164, 2166, 2167, 2169-2172, inclusive, 2200-07 inclusive.

"National" couplings for connecting rigid to flexible conduit, catalog Nos. 21900-95 inclusive. (See cut.)

"National" couplings for connecting flexible conduits, catalog Nos. 2184-89 inclusive; couplings for use in car wiring, catalog Nos. 2182-83.



Electric Heater.—Current Electric Company.

Approved April 28 1914.

CONDUIT OUTLET BUSHINGS, COUPLINGS AND FITTINGS.—Pittsburgh Valve and Fitting Company, Barberton, O.

"P" outlet bushing made of malleable cast iron, galvanized, for use with 0.5-inch to 3-inch sizes of rigid steel conduit.

Approved May 29, 1914.

CURRENT TAPS.—Harvey Hubbell, Incorporated, Bridgeport, Conn.

"Hubbell" current taps, 660 watts, 250 volts.

Multiple type, catalog Nos. 5,454, 5,625, 5,638, 5,735.

Series type, Catalog Nos. 5,510, 5,540. 5,526.

Approved May 22, 1914.

ELECTRICALLY ILLUMINATED CASH REGISTER.—American Cash Register Manufacturing Company, Saginaw, Mich.

On each side of the cash register is placed an arm to which is attached a miniature socket and lamp. A switch is mounted inside the case which is operated by the cash drawer, closing when the drawer opens, and vice versa.

Approved May 29, 1914.

FASTENERS FOR FLEXIBLE TUBING.—Hart & Hegeman Manufacturing Company, Hartford, Conn.

Fasteners, catalog Nos. 5,007 and 5,008, for securing flexible tubing in switch and outlet boxes. Brass rings with flanges to engage edges of holes in boxes and having teeth to grip 0.25 and 0.375-inch tubing.

Approved June 2, 1914.

FIXTURES.—General Electric Company, Schenectady, N. Y.

Advertising display fixture, 250 watts, 120 volts. Window transparency, bearing the words "His only rival, Edison G. E. Mazda" and a representation of a lamp, the earth and the sun, on the front of a cabinet containing one 100-watt and six 10-watt incandescent lamps and a thermal flasher. A terminal block and connector are provided for the supply cord.

For use on ordinary lighting circuits.

Approved May 22, 1914.

FIXTURE WIRE.—Standard Underground Cable Company of Canada, Limited, Hamilton, Ontario, Canada.

Marking: Green thread woven in braid in a counter-clockwise direction.

Fixture wires shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with requirements of the National Board of Fire Underwriters, and examined at factories and passed by Underwriters' Laboratories, have labels attached to coils.

Approved June 4, 1914.

HEATERS, Electric.—The Current Electric Company, 18 East Kinzie Street, Chicago, Ill.

Electric furnace for heating soldering irons, 105-115 volts, 2.3 amperes. (See cut.)

Approved May 4, 1914.

LAMP GUARDS.—Benjamin Electric Manufacturing Company, 128 South Sangamon Street, Chicago, Ill.

"Benjamin" catalog No. 261-VP, for use in garages or damp places.

Approved May 9, 1914.

ROSETTES, Fuseless.—Harvey Hubbell, Incorporated, Bridgeport, Conn.

Ceiling pull-switch rosettes, catalog No. 5,949.

Approved May 23, 1914.

ROSETTES, Fuseless.—Pass & Seymour, Incorporated, Solvay, N. Y.

Pull-switch rosettes, 3 amperes, 125 volts; 1 ampere, 250 volts; catalog Nos. 700-702 incl., and 704-712 incl.

Approved May 29, 1914.

SIGNAL SYSTEM.—Western Electric Company, 463 West Street, New York, N. Y.

1-A, 1-B, 1-C, 2-A, 2-B "Code Signaling Sets" with "Subscriber's Set," No. 262-F.

For use only on battery circuits or circuits of not over 30 volts, supplied from motor-generator sets to give code signals on systems of bells or buzzers either separately or in connection with telephone systems.

Approved May 29, 1914.

SOCKETS, Standard.—The Bryant Electric Company, Bridgeport, Conn.

"Bryant" porcelain shell sockets.

Key, 250 watts, 250 volts; catalog Nos. PP-70, RW-70.

Keyless, 660 watts, 250 watts; catalog Nos. PD-73, PP-73, RW-73, 4,059, 9,393.

Pull, 250 watts, 250 volts; catalog Nos. PD-75, PP-75, RW-75.

Approved June 3, 1914.

SOCKETS, Standard.—Chapman & Walker, Limited, Toronto, Canada, manufactured by **Sterling Telephone & Electric Company, Limited,** London, England.

Brass shell, 250 watts, 250 volts.

Pull, catalog No. A-566.

Approved June 2, 1914.

SWITCHES, Push-Button Flush.—Chelten Electric Company, 314 Armat Street, Philadelphia, Pa.

Single-pole, 5 amperes, 250 volts, 10 amperes, 125 volts; catalog No. 6000.

Double-pole, 10 amperes, 250 volts; catalog No. 6001.

Three-way, 5 amperes, 250 volts, 10 amperes, 125 volts; catalog No. 6002.

Also above types with lock attachment.

Approved May 18, 1914.

SWITCH BOXES.—Connecticut Electric Manufacturing Company, Bridgeport, Conn.

Pressed-steel boxes for mounting flush switches and receptacles.

For flexible tubing, catalog Nos. 6,080 and 6,081.

For conduit, catalog No. 6,082.

Approved June 2, 1914.

SWITCH BOXES, Supports for.—Alex. M. Knauber & Company, 742 S. Euclid Avenue, Oak Park, Ill.

Formed strap-iron supports designed for the mounting of outlet boxes in hollow walls and ceilings. The supports are perforated with numerous oblong holes for convenience in fastening them to studs and joists and for the convenient adjustment of the various outlet boxes.

Approved June 2, 1914.

SWITCHES, Pendent Snap.—The Gordon Electric & Manufacturing Company, 403 Masonic Temple, Chicago, Ill.

"Gem" single-pole, 3 amperes, 250 volts, 6 amperes, 125 volts; catalog No. 27.

Approved June 3, 1914.

SWITCHES, Pendent Snap.—The Gordon Electric & Manufacturing Company, 403 Masonic Temple, Chicago, Ill.

Pendent snap switches shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with requirements of the National Board of Fire Underwriters, and examined at factories and passed by Underwriters' Laboratories, have labels attached to each device.

Approved June 4, 1914.

SWITCHES, Rotary Flush.—Chapman & Walker, Limited, submitters, 118-120 Richmond Street, West, Toronto, Canada. Manufactured by **Sterling Telephone & Electric Company, Limited,** Telephone House, 210-212 Tottenham Court Road, London, West, England.

Rotary flush switches shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with requirements of the National Board of Fire Underwriters, and examined at factories and passed by Underwriters' Laboratories, have labels attached.

Approved June 2, 1914.

Single-pole, 10 amperes, 125 volts, 5 amperes, 250 volts; catalog, No. A-162.

Four-way, 5 amperes, 125 volts, 2 amperes, 250 volts; catalog No. A-165.

Double-pole, 10 amperes, 250 volts; catalog No. A-168.

Approved June 3, 1914.

SWITCHES, Surface Snap.—General Electric Company, Schenectady, N. Y.

"G. E." with metal covers.

Single-pole, 5 amperes, 125 volts, 3 amperes, 250 volts; catalog Nos. GE180-GE183 inclusive.

Approved May 4, 1914.

TUBING, Flexible.—The Flexible Conduit Company, Limited, Guelph, Canada.

Marking: Black thread parallel with axis between the fiber linings.

Flexible tubing shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with requirements of the National Board of Fire Underwriters, and examined at factories and passed by Underwriters' Laboratories, has label attached.

Approved April 24, 1914.

TRANSFORMERS.—O. J. Goettmann, 525 East Ohio Street, Pittsburgh, Pa.

100 watts, B. & S. type. Air-cooled transformer for indoor or outdoor use, 110-volts primary; 2.5 to 32.5 volts secondary.

Approved May 22, 1914.

TRANSFORMERS.—Empire Transformer Company, 2846-56 Evanston Avenue, Chicago, Ill.

"Empire" bell ringer, for use on lighting circuits. Primary, 110 volts, secondary, 6 volts. To be used for ringing bells or for similar signaling work when primary wiring is installed in accordance with Class C of the National Electrical Code.

Approved May 29, 1914.

WELDING MACHINES.—Detroit Electric Welder Company, 253-5 LaFayette Avenue, West, Detroit, Mich.

"Vollans" welders, types H, B, K, 110 or 220 volts.

These machines are used to effect the union of pieces of metal by compression after softening by heat produced electrically.

Standard when installed with ground connection acceptable to the Inspection Department having jurisdiction.

Approved June 9, 1914.

WELDING MACHINES.—The Fisher Motor Company, Limited, Walkerville, Ontario, Canada.

"Vollans" welders, type H, B, and K, 110 or 220 volts.

These machines are used to effect the union of pieces of metal by compression after softening by heat produced electrically.

Standard when installed with ground connection acceptable to the Inspection Department having jurisdiction.

Approved June 10, 1914.

WELDING MACHINES.—The Toledo Electric Welder Company, Knowlton and Langland Streets, Cincinnati, Ohio.

"Toledo" welders; 5 to 150 watts, 110, 220 or 440 volts.

These machines are used to effect the union of pieces of metal by compression after softening by heat produced electrically. Standard when installed with ground connection acceptable to the Inspection Department having jurisdiction.

Approved June 2, 1914.

WIRE, Rubber-Covered.—A A Wire Company, 48 Nesbitt Street, Newark, N. J.

Marking: Two or more olive green threads parallel with the wire between insulation and braid.

Rubber-covered wires shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with requirements of the National Board of Fire Underwriters, and examined at factories by Underwriters' Laboratories, have labels attached to coils.

Approved June 5, 1914.

WIRES, Rubber-Covered.—Standard Underground Cable Company of Canada, Limited, Hamilton, Ontario, Canada.

Marking: Green thread woven in braid in a counter-clockwise direction.

Rubber-covered wires shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with requirements of the National Board of Fire Underwriters, and examined at factories and passed by Underwriters' Laboratories, have labels attached.

Approved June 5, 1914.

Current Electrical News

NORTH ATLANTIC STATES.

SOUTHBORO, MASS.—This place may erect a $125,000 electric plant. Address the town clerk.

JERSEY CITY, N. J.—The Board of Education will receive bids up to July 15 for improvements at its boiler and steam heating plants in the public schools. The work is estimated to cost $10,000. John Callahan is chief engineer. A.

SOUTH ATLANTIC STATES.

ASHEVILLE, N. C.—One of the biggest development schemes undertaken in western North Carolina in recent years is that of the Industrial Power Company, a recently incorporated firm with an authorized capital stock of $100,000, which will build a hydroelectric power plant on the banks of the French Broad River, near Hot Springs, for the purpose of furnishing power to the industries of that town. Archibald Nichols, J. E. Rector and S. M. Hanss of Asheville are president, secretary and treasurer respectively.

SCOTLAND NECK, N. C.—The city will expend $10,000 in enlarging the electric light and power plant. Address L. R. Mills, Jr.

DENMARK, S. C.—The Denmark Light & Power Company, has been incorporated with a capital stock of $10,000, by C. D. Campbell, T. M. Phifer and others.

CANTON, GA.—$5,000 will be expended improving the electric light plant. Address the mayor in regard to the matter.

APOPKA, FLA.—On July 18 an election will be held to decide the question of issuing $9,000 in bonds for establishing an electric light plant. Address the mayor for further particulars.

BONIFAY, FLA.—The city is considering the proposition from the Chipley Light & Power Company, Chipley, Fla., to furnish 24-hour street-lighting service. Address the city clerk for general information.

NORTH CENTRAL STATES.

ATHENS, O.—A power plant which will furnish current to the proposed electric line between Athens and Nelsonville is part of the program of a party of English investors and Athens business men, including F. L. Preston and others, who are promoting the construction of the line. The English party has agreed to invest $100,000 in the line if the Athens capitalists will contribute $25,000, making up the amount estimated as necessary to do the work. L.

CANTON, O.—The electric plant owned and operated by O. C. Barber, at Howenstine, O., in connection with his lime plant, in which several generators of 600 horsepower are used, is to be greatly enlarged, to make a power plant costing over $2,000,000, according to plans which are under way. If a sufficient fuel supply is available, and if a market such as is believed to be ready for the current developes, work will proceed at once on the proposed extensions. L.

CLEVELAND, O.—The municipal light department will soon submit to the City Council plans for the $2,000,000 municipal lighting plant to be erected at East Fifty-third Street.

FREMONT, O.—The Ohio Light & Power Company, owner of the local electric lighting plant, is about to double its capacity.

MASSILLON, O.—There will be a large amount of electrical equipment required, some of which has already been purchased or contracted for, in the construction of the plant of the Central Steel Company, which has been begun. An 8,000-horsepower motor will be used to drive the Blooming mill, twelve electrically-driven traveling cranes will be used, the furnace doors and valves will be electrically operated, and other electrical equipment will be installed. It is proposed to make the plant the most complete in the country in the matter of electrical operation. The Massillon Steel Company is under the same management. L.

NORWALK, O.—The city will issue bonds to the amount of $120,000 for the purpose of constructing a municipal electric-lighting plant, an election on the question resulting in a vote favorable to the bonds. The franchise of the Cleveland, Southwestern & Columbus Railway Company, which has been furnishing current to the city, will expire in September, 1915, and by that time the proposed city plant will be completed. Arrangements for design and construction will begin at once. L.

PORT CLINTON, O.—A municipal electric lighting plant is proposed here, and a mass meeting is to be held to determine whether an election will be called to vote on the proposition, or whether a contract will be entered into with the Port Clinton Electric Light & Power Co. L.

BLOOMFIELD, IND.—At a special session of the Board of Trustees of Bloomfield an ordinance was adopted directing the New Home Telephone Company to take down its poles on certain of the principal streets and place the wires underground.

TELL CITY, IND.—Improvements and remodeling of the city's electric light plant will be covered by a $17,000 bond issue which has been voted by the City Council. G.

JACKSON, MICH.—In the ten-year street-lighting contract just entered into between the city and the Commonwealth Power Company provision was made for the immediate installation of an ornamental tungsten cluster system on the business streets of the city.

SAINT CLAIR HEIGHTS, MICH.—The village trustees plan a new light system. Address Francis J. Miller, president of the Village Board.

MADISON, WIS.—The American Utilities Company, owner of the La Crosse Gas & Electric Company, has filed articles of incorporation for a $10,000,000 Company to be known as the Wisconsin-Minnesota Light & Power Company, of La Crosse, Joseph H. Brewer, president, and Blaine Gavette, secretary. C.

SUPERIOR, WIS.—Members of the City Commission are now considering a street lighting plan which eventually may mean the extension of the "White Way" system into the residence district. Address W. H. Winslow, general manager of the Superior Water, Light and Power Company.

BAGLEY, MINN.—J. F. Druar, consulting engineer, Commercial Building, St. Paul, Minn., has been directed to prepare plans for rebuilding the electric light plant at Bagley.

LAKE BENTON, MINN.—L. W. Liddle has practically closed a deal to install electric lighting here. A franchise has been granted. C.

WESTBROOK, MINN.—The Westbrook Electric Light & Power Company, has been incorporated with a capital stock of $10,000, by K. Krueger, John E. Villa and others.

DES MOINES, IOWA.—A municipal street lighting system to replace the Welsbach gas lights is being considered by the City Council. C.

LYONS, IOWA.—The Commercial Club is working for an extension of the ornamental lighting system. Address the secretary of the club.

SILVER CITY, IOWA.—The McKinley Company will supply power for lighting service for this city. C.

WYOMING, IOWA.—At a special election held for the purpose of granting a franchise to William G. Dows, Isaac B. Smith and John A. Reed, to construct, maintain and operate an electric light plant in the town of Wyoming, the proposition carried.

CLARENCE, MO.—$10,000 in bonds have been voted for an electric plant. Address the city clerk.

CABOOL, MO.—Only one vote was cast against a bond issue for an electric light plant at the recent election at Cabool. About $7,500 is available for the work. M.

HAMILTON, MO.—C. A. Martin and T. D. Parr have secured a franchise for operating an electric light plant at Hamilton, Mo. M.

PATTONSBURG, MO.—An election will be held at Pattonsburg in the near future to vote a franchise for an electric light plant. M.

LAREDO, MO.—Plans have been completed for a "White Way" at Laredo. Sixteen lights will be installed on the principal streets at a distance of 125 feet apart. M.

WESTBY, N. D.—Arrangements have been made for the establishment of an electric light plant here. C.

ARMA, KANS.—An election will be held at Arma on July 14 to vote on a bond issue of $8,000 for the construction of an electric light plant or the purchase of power from some other city. Henry Cote is mayor. M.

CANTON, KANS.—There is a possibility that Canton will get electric lights before the end of the year. The Canton Milling Company has offered to furnish power for 24-hour service if the city will put in the electric light equipment.

LACROSSE, KANS.—The City Council is planning to expend $12,000 in improving the electric light plant. Address the city clerk.

LEAVENWORTH, KANS.—W. J. Squires, head of the Squires Electrical Company, of Kansas City, Mo., has purchased the Brighton mine here and will spend $500,000 in the construction of a power plant at the mouth, and in electrical equipment. M.

SOUTH CENTRAL STATES.

BURKESVILLE, KY.—George H. Greenup and associates have purchased a franchise authorizing them to install electric light and power and water service here. G.

DANVILLE, KY.—The Danville Light, Power & Traction Company has filed an amendment to its charter increasing its authorized capital from $50,000 to $100,000. G.

LAGRANGE, KY.—The town council has granted the Louisville Gas & Electric Company a permit to enter the corporation limits with transmission wires to supply service. The wires have been extended from Louisville as far as Crestwood, only a few miles west. G.

LOUISVILLE, KY.—Contracts involving from $8,000 to $10,000 for the electrical work in the new $300,000 Boys' High School are to be let soon by Bailey & Koerner, Walker Building, Louisville, who have obtained the general contract for the construction of the building. They are receiving bids now and mailing specifications to those who ask for them, though they have not advertised for bids as yet. The work will include equipment for a vacuum cleaner service, house telephones, clock service and the lighting system. G.

LOUISVILLE, KY. — Motor-driven machinery will be used in the new Globe Fertilizer Plant to be built here by the Federal Chemical Company to replace its old plant, which was recently destroyed by fire. G.

LOUISVILLE, KY.—An electrical hoist, consisting of a motor, drum and some 500 feet of cable, is to be installed by the Patterson Sand Company, 2615 Crop Street. G.

MARYVILLE, TENN.—Eastern capitalists are to buy the Maryville Electric Light Company, according to a statement recently attributed to W. E. Hunter, of Knoxville, Tenn. Mr. Hunter and associates, who have asked for a charter to establish the Maryville Ice & Cold Storage Company, have been negotiating for the sale of the lighting plant for some time. G.

BAY MINETTE, ALA.—An electric light plant will be established here at a cost of $35,000. Address W. D. Stapleton, mayor.

WINNSBORO, LA.—A lighting plant ample to take care of the lighting of the entire town will be installed by Carl Ship at once.

NOWATA, OKLA.—The Nowata Electric Light Company has been incorporated with a capital stock of $30,000, by E. B. Lawson, Frank Hancock and others.

DE LEON, TEX.—The Le Leon Gorman Light & Power Co., contemplates operating an electric light plant here.

SAN ANTONIO, TEX.—The San Antonio Gas & Electric Company has completed plans for extension of its plant on Conception Road. A large additional battery of boilers will be installed and a 5,000-kilowatt steam turbogenerator with exciters. This will practically double the capacity of the plant. E. E. Eysenback is general manager.

WINDOM, TEX.—Windom Light & Power Company has been incorporated with a capital stock of $5,000 by A. L. Clark, J. J. Cappleman and E. P. Price.

WESTERN STATES.

BILLINGS, MONT.—Ornamental street lighting is to be installed here. Address the city clerk.

FORT BENTON, MONT.—The City Council is considering the purchase of the power plant from the Benton Electric Company, and has passed an ordinance providing for the sale of $17,000 in bonds, to be used for this purpose. If the plant is taken over, some needed extensions and improvements will be made to the plant. O.

SALT LAKE CITY, UTAH.—Property owners on State Street in this city on June 23 organized the State Street Improvement Association; H. Pingree, cashier of the National City Bank, is president. One of the objects is to promote an elaborate system of ornamental street lighting. A committee was appointed to investigate the various systems of street lighting now available and present the same to the association at the next meeting. U.

SALT LAKE CITY, UTAH.—The Dooly Building Power Company has made application to the City Commission for a franchise to furnish electricity and steam heating in Salt Lake City. The application is accompanied by a letter stating that the company intends to extend its service only throughout the immediate vicinity of its present plant. U.

DAYTON, WASH.—The County Commissioners of Garfield County, have granted a 50-year franchise to the Pacific Power & Light Company, to construct and maintain power-transmission lines throughout the county. O.

RIDGEFIELD, WASH.—J. H. Cunningham, of Portland, has been granted franchises for electric light and water systems. Construction on the electric light plant, and water works will commence as soon as possible and will be rushed to completion.

WENATCHEE, WASH.—The County Commissioners of Chelan County recently granted a franchise to the Cashmere Water Power Company here to erect and maintain poles, wires, and electrical appliances for power transmission lines on highways and bridges between this city and Leavenworth. The work will be started shortly. O.

ASTORIA, ORE.—The Marconi Wireless Company recently purchased 16 acres of land here, upon which it will erect a powerful wireless station. It is announced work of construction will be commenced as soon as materials can be purchased and delivered. O.

NORDHOFF, CAL.—The Railroad Commission has authorized the Ojai Power Company, operating an electric light, power and water system in the Ojai Valley, to issue capital stock of the par value of $19,200. The proceeds derived from the sale of the stock are to be used for betterments and extensions to the present system.

LOS ANGELES, CAL.—The Board of Supervisors has approved specifications for lighting Laurel Canyon, and will call for bids immediately.

VENICE, CAL.—The Neptune Light & Power Company, has been incorporated with a capital stock of $5,000, by J. O. Kaiser, L. Bukowski, F. Seeman and others.

PROPOSALS.

CABLE.—Sealed proposals will be received by the United States Reclamation Service, Los Angeles, Cal., until July 6 for furnishing 1,200 feet No. 6 B. & S. triple-conductor cable. For further information apply to O. H. Ensign, Electrical Engineer.

ELECTRIC WIRING.—Sealed bids will be received by the Board of Education until July 6 for the electric wiring of an addition to the High School, Beloit, Wis. Plans are on file at the office of Crumpacker & Wyatt, architects, Atchison, Kans., and with Dr. E. E. Brewer, of Beloit. A certified check for $50 must accompany all bids. M.

CABLE.—Sealed proposals will be received at the Engineer Depot, U. S. Army, Washington Barracks, D. C., until July 6 for furnishing 4,200 feet, 212,000-circular-mil, stranded single-conductor and lead-covered cambric-insulated armored cable. For further information apply to Joseph E. Kuhn, Lieutenant Colonel of Engineers.

ELECTRIC WIRE.—Bids will be received July 10 for furnishing the department of Gas and Electricity, Chicago, Ill., 160,000 feet of No. 14 duplex rubber-covered wire, or its cost equivalent in other sizes, strictly in accordance with specifications on file in the office of Commissioner of Gas and Electricity. Address Ray Palmer, city electrician, for desired information.

MOTORS AND TRANSFORMERS.—Electrical equipment for the Memphis, Tenn., pumping station is to be purchased. Bids will be received until July 14 for four 750-horsepower induction motors, horizontal shaft, and two 300-horsepower induction motors, vertical shaft, all complete with switchboard and control apparatus; also three single-phase transformers. Address C. C. Pashby, city clerk.

ELECTRICAL WORK.—The Board of Public Works, Kansas City, Mo., will receive bids for the electric light and power wiring, telephone and signal system and other electrical work in the tuberculosis hospital to be erected on the municipal farm near Leeds, Mo., until

July 10. Plans may be secured from Edgar P. Madorie, Reserve Bank building. The receipt of the city comptroller for a deposit of $200 must accompany all bids. E. J. McDonnell is secretary of the Board of Public Works. M.

MOTOR DRIVEN MACHINERY.—The Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will receive bids for the following machinery until the dates given. Bidders should get copies of the schedule numbers given from the office mentioned above. Until July 28—schedule No. 6969, a four-plunger hydraulic pump, a slip-roll forming machine, a universal bench saw. Until August 4—schedule No. 6981, three compound geared winches, one capstan, and spare parts.

LIGHTING FIXTURES.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until July 29, for the lighting fixtures for a one-story building for the post office at Garden City, Kans.; until July 30 for the same for the post office at Cookeville, Tenn.; until August 3 for the same for a two-story building for the post office at Three Rivers, Mich.; and until August 6 for the same for a two-story building for the post office at Gary, Ind., all in accordance with drawings and specifications, copies of which may be obtained from the custodians of the sites named or the office of the Supervising Architect.

NAVY ELECTRICAL SUPPLIES.—The Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will receive bids for the following material until the dates given. Bidders should get copies of the schedule numbers given from the office mentioned above or the navy pay office nearest each navy yard. Until July 7—schedule No. 6940, 580 feet three-quarter-inch brass conduit, 5,000 feet three-quarter-inch steel electrical conduit. Until July 14—schedule No. 6946 3,000 feet twisted silk-braid 110-volt lamp cord; schedule No. 6943 a lubricating-oil testing outfit complete with electric motor, heating device, etc.

NEW INCORPORATIONS.

CLARKSTON, MICH.—The Oakland Power Company has been incorporated with a capital of $100,000.

ASHLAND, KY.—Camden Power Company has been incorporated with a capital stock of $100,000 by John F. Hager, J. W. M. Stewart and K. M. Fitzgerald.

AUGUSTA, ME.—Lunt & Heath has been incorporated to deal in all kinds of electrical supplies, etc. The capital stock is $50,000. E. M. Leavitt is president of the company.

WINDOM, TEX.—The Windom Telephone Company has been incorporated with a capital of $5,000. The incorporators are A. L. Clark, J. J. Cappleman and E. P. Price.

LOS ANGELES, CAL.—Butts Electric Manufacturing Company has been incorporated with a capital stock of $25,000. The directors are C. T. Butts, W. H. Butts and A. C. Hurt.

TOMAHAWK, WIS.—The Tomahawk Rural Telephone Company has been incorporated with a capital of $5,000. The incorporators are C. E. Macumber, J. A. Fitzgerald and Edward Everson.

SPARTANBURG, S. C.—The Shores-Osborne Electric Company has been granted articles of incorporation, capitalized at $15,000. The incorporators are R. A. Shores, Wallace Osborne and C. E. Rogers.

NASHVILLE, TENN.—Bays Mountain Electric Company has been incorporated, capitalized at $25,000. The incorporators are Joseph Burger, J. L. Clark, Ernest Koella, Clay Cunningham and T. N. Brown.

MANHATTAN, N. Y.—Electronium Company, Incorporated, has been granted articles of incorporation, capitalized at $100,000. The incorporators are H. Thurston, H. S. Knight, T. F. MacMahon, all of New York City.

LADOGA, IND.—The Ladoga Telephone Company, of this city, has been incorporated to operate a telephone system. The capital is $20,000 and the incorporators are John M. Stanley, H. A. Foster and S. H. Foster.

LOS ANGELES, CAL.—The Electric Ozonizer Manufacturing Company has been incorporated with a capital stock of $150,000. The directors are B. H. Rothwell, F. C. Garbutt, T. Holt, F. Kennedy and H. S. Caldwell.

NEW YORK CITY.—Owners' & Tenants' Electric Company, Incorporated, has been chartered with a capital of $10,000. The incorporators are Fred H. Cluff, Edward Cluff and Jacob Fox, all of 95 William Street, New York City.

NEW YORK, N. Y.—Sanandres Wireless & Aero Visible Message Company, Incorporated, has been organized with a capital of $100,000. The incorporators are Charles B. Mason, Antello Mattera and Antonio Sanandres, all of New York City.

INDIANAPOLIS, IND.—The H. W. Schwimmer Company has been incorporated with a capital stock of $10,000 to deal in electrical appliances. The incorporators are Hugh R. Richards, Henry W. Schwimmer and Charles B. Foster.

NEW YORK, N. Y.—Berkowitz Electrical Contractors, Incorporated, has been granted articles of incorporation, capitalized at $500. The incorporators are Myer Oshatz and Isaac Berkowitz, of Brooklyn; and Philip Birmdaum, of New York City.

ABERDEEN, S. D.—The Cornell Telephone Company has been incorporated to conduct a telephone business in Sanborn County. The capital is $10,000; the incorporators are W. F. Briggs, of Forestburg, A. F. Briggs and Henry Fell, of Woonsocket.

CHICAGO, ILL.—Alladin Electric Company has been granted articles of incorporation, capitalized at $10,000 to deal in electrical and automobile merchandise and supplies. The incorporators are Samuel P. Marmly, Jr., Norman C. Croshaw and Joseph Bonomo.

SAN DIEGO, CAL.—The Perfect Protection Telephone Company has been organized with a capital stock of $50,000 by Josephine A. Hall, S. M. Hall, Sarah E. Swisler, F. F. Johnson and S. K. Johnson, all of San Diego, for the purpose of marketing a sanitary telephone mouthpiece.

NEW YORK, N. Y.—Ecropean Light Company, Incorporated, has been granted articles of incorporation to deal in gas and electric fixtures, lamps, etc. The capital stock is $50,000 and the incorporators are Randolph M. Smiley, E. J. Reeves and Ernest A. Stienen, of New York City.

CHICAGO, ILL.—The Acme Electric Storage Battery Company has been granted a license to incorporate by the secretary of state. The company's capital stock is $14,000 and it is to manufacture and deal in storage batteries. The incorporators are Roy Brundage MacDowell, Sidney J. Hall and A. C. Hunt. Z.

CHICAGO, ILL.—The Secretary of State of Illinois has granted the Anasco Asbestos Asphalt Products Company of Chicago a license to incorporate. The company is to manufacture, produce and deal in water proofing, roofing, paving, paint and insulating materials, asbestos products, etc. The capital stock is $50,000 and the incorporators are Richard N. Simpson, W. Barrett Fitzgerald and Elsie R. Beifuss. Z.

FOREIGN TRADE OPPORTUNITIES.

[Where addresses are omitted they may be obtained from the Bureau of Foreign and Domestic Commerce, Washington, D. C., and at the branch offices of the Bureau, 315 Customhouse, New York, N. Y., 629 Federal Building, Chicago, Ill., Association of Commerce Building, New Orleans, La., and 310 Customhouse, San Francisco, Cal. Apply for addresses in letter form, giving file numbers.]

NO. 13,252. ELECTRICAL MACHINERY, ETC.—A naturalized American citizen, temporarily residing in a European country, is a competitor for a contract about to be given out by local municipal authorities for the construction of an electric plant, an electric railway about 12 miles in length, and for piping of water to the city and distributing it in the municipal limits. The amount to be expended will be about $500,000. Firms supplying electrical machinery, steel rails, etc., should address this person in English.

NO. 13,268. AUTOMATIC CONTROLLER.—The Sydney & Suburban Hydraulic Power Company (Limited), 14 Martin Place, Sydney, Australia, offers a premium of $1,000 for an improved device of automatic control of hydraulic elevators. Such device is required to start and stop the car at any floor desired and to prevent the opening of the sliding doors of the well inclosures on all floors until the car is in position, to be operated by hydraulic power or by electricity, inside the car and on all floors. Such devices should be placed in charge of the company before the end of 1914.

NO. 13,269. POWER PLANT.—Separate tenders will be received at the Town Clerk's Office, Auckland, New Zealand, until August 6 for the supply and erection in the City Council power station of three 750-kilowatt direct-current mixed-pressure turbogenerators; one 1,500-kilowatt three-phase turbogenerator, including auxiliary plant and substation equipment. Specifications and drawings may be obtained from Price, Cardew & Snell, 8 Queen Anne's Gate, London, S. W., England, on payment of $9.73, which will be refunded on receipt of a bona fide tender.

NEW PUBLICATIONS.

The J. G. WHITE CORPORATION.—The J. G. White Management Corporation, New York City, has issued a booklet entitled, "The Management of Public Service." This publication considers the subject of management of public utilities, and the facilities of the company for undertaking such management.

FINANCIAL NOTES.

A certificate increasing the capital of New York Telephone Company from $125,000,000 to $150,000,000 has been filed at Albany, N. Y.

The Nashville Traction Company has filed an amended charter increasing its capital stock from $500,000 to $1,000,000. The lines of the company, which have not yet started operating cars, will be extended to Una, Tenn., and will also connect the Nashville-Gallatin and the Nashville-Franklin interurban railways.

Of the $30,000,000 Western Union stock offered, 47.2 per cent was subscribed for by Western Union stockholders. Of the remaining 52.8 per cent, 50 per cent was distributed among participants in the underwriting syndicate a month ago, and the remaining 2.8 per cent was taken up on the expiration of the underwriting agreement.

The Texas Power & Light Company has sold $700,000 first mortgage five-per-cent bonds to Harris, Forbes & Company, New York, who are offering them at 93.5. Bonds are dated June 1, 1912, and are due June 1, 1937, and are optional at 105 and interest on any interest-payment date on or after June 1, 1917. The bonds form part of an authorized issue of $30,000,000, of which, including the present amount, there are $4,790,000 outstanding.

Hodenpyl, Hardy & Company, E. W. Clark & Company and the National City Company, New York, are jointly offering $5,000,000 five-year first-lien six-per-cent gold notes of the Michigan Railway Company, dated June 1, 1914, redeemable at 103 per cent and interest on June 1 or December 1, 1916; 102 per cent and interest on June 1 or December 1, 1917, and 101 per cent and interest on June 1 and December 1, 1918, payment of which is guaranteed by the Commonwealth Power, Railway & Light Company. The issue is secured by first mortgage through pledge of the entire outstanding amount, $6,250,000 first-mortgage five-per-cent bonds of the Michigan Railway Company, upon the entire property of that company, comprising 45.35 miles of interurban electric railway in actual operation, 42.42 miles of steam railroad now being equipped for electric operation, and 56.83 miles additional interurban electric railway, which will be in operation by January 1, 1915.

At a meeting of the directors of the Marion & Bluffton Traction Company at Bluffton, Ind., the following officers were elected on June 17: President, James W. Sale; vice-president, Abram Simmons; secretary and general manager, W. A. Patton; treasurer, Dell Locke. James S. Clark was appointed auditor, and George A. Redd superintendent of transportation.

Dividends.

	Term.	Rate.	Payable.
Am. Pub. Serv. pf.	Q	1.75%	July 1
Augusta-Aiken Ry. & El. pf.	Q	1.5 %	June 30
Bay State St. Ry. 1st pf.	S-A	$3	Aug. 1
Bell Tel. of Penn.	Q	1.5 %	July 15
Cities Serv. com.	M	0.5	Aug. 1
Cities Serv. com.	M	0.5	Sept. 1
Cities Serv. pf.	M	0.5	Aug. 1
Cities Serv. pf.	M	0.5	Sept. 1
Citz. Trac. pf.	—	2.5 %	July 6
Ed. El. Ill. of Boston.	Q	3 %	Aug. 1
Int. Trac. pf.	S-A	2 %	July 15
Jacksonville Trac. com.	Q	$1.75	Aug. 1
Jacksonville Trac. pf.	Q	$1.50	Aug. 1
Kan. Gas & El. pf.	Q	1.75%	July 1
Kellogg Sw. special	—	15 %	June 29
Mass. Light Cos.	Q	1.75%	July 15
Mass. Light Cos. new pf.	—	1.5 %	July 15
Mass. Light Cos. new com.	—	0.25%	July 15
Monongahela Val. Trac. com.	—	1.5 %	July 1
Mont. Teleg.	Q	2 %	July 15
Mont. Tram.	Q	2.5 %	Aug. 1
North. States Pr. pf.	Q	1.75%	July 15
Pac. Tel. & Tel. pf.	Q	1.5 %	July 15
Porto Rico Rys. com.	Q	1 %	July 1
Porto Rico Rys. pf.	Q	1.75%	July 1
Pub. Serv. Invest.	S-A	2 %	Aug. 1
Pub. Serv. Invest. pf.	Q	1.5 %	Aug. 1
Sierra Pac. El.	Q	1.5 %	Aug. 1
So. Cal. Edison pf.	Q	1.5 %	July 15
Springfield & Xenia Trac. pf.	—	1.5 %	June 30
Texas Trac. pf.	Q	6 %	
Un. Gas & El. pf.	S-A	2 %	July 15
Un. Ry. & El.	Q	1 %	July 15
W. Kootenay Pr. & Lt. pf.	Q	1.75%	July 1
West. Sts. Gas & El. pf.	Q	1.75%	July 15
Westinghouse Elec. & Mfg. pf.	Q	1.75%	July 15
Westinghouse Elec. & Mfg. com.	Q	1 %	July 30
Youngstown & Ohio Riv. R. R.	Q	1 %	June 30

Reports of Earnings.

HUDSON & MANHATTAN.

	1914.	1913.
April gross	$ 484,776	$ 467,693
Net after taxes	287,834	265,987
Total income	274,344	252,496
Surplus available for interest on adjustment income bonds	79,827	65,341
Four months' gross	1,911,468	1,864,833
Net after taxes	1,123,620	1,036,829
Total income	1,069,660	1,023,359
Surplus available for interest on adjustment income bonds	292,421	.....

NEW YORK RAILWAYS.

	1914	1913
April gross	$ 1,148,888	$ 1,232,761
Net after taxes	319,598	361,500
Other income	31,626	22,582
Total income	351,224	384,082
Interest on underlying bonds	222,179	223,381
Income available for interest on company's bonds	129,045	160,720
Interest on refunding 4s	54,320	54,320
Surplus	74,725	106,400
Ten months gross	11,485,016	11,683,730
Net after taxes	3,257,096	3,438,268
Other income	321,170	342,040
Total income	3,578,266	3,780,308
Interest on underlying bonds	2,224,623	2,247,395
Income available for interest on company's bonds	1,353,644	1,532,914
Interest on refunding 4s	543,198	543,198
Surplus	810,446	989,716
Passengers carried	226,341,746	227,016,031

Operating expenses include reserve imposed upon the company by order of the Public Service Commission ,now in litigation.

ORO ELECTRIC CORPORATION.

The report of the Oro Electric Corporation for the year ended December 31, 1913, shows net earnings of $114,333, as compared with $98,059 for the fourteen months ended December 31, 1912, the period covered by the last previous report. The income account compares as follows:

	1913	1912
Gross earnings	$221,894	$197,034
Net after taxes	114,333	98,059
From subsidiaries	284,139	300,625
Total income	$398,472	$398,684
Interest charges	*42,767	37,500
Dividends	87,500	227,500
Surplus	$268,205	$133,684

*Interest charges to construction, $58,768.

ROCHESTER TELEPHONE.

Rochester Telephone Company has issued its report for the year ended December 31, 1913. The income account compares as follows:

	1913	1912
Gross revenue	$465,693	$441,422
Operating income	166,699	167,876
Bond interest	53,580	62,565
Balance	113,119	105,311
Depreciation on reserve	54,452	50,880
Surplus	58,667	54,431

MONTREAL WATER & POWER.

Montreal Water & Power for fiscal year ended April 30, 1914, reports income account as follows:

	1914	1913
Gross earnings	$783,689	$671,684
Net after taxes	459,349	372,237
Balance after charges	208,812	131,398
Surplus after deductions	*92,161	92,570
Accumulated surplus	189,042	96,881

*Depreciation charge of $60,000 not made in preceding year.

NEW ENGLAND POWER COMPANIES.

	1914	1913
May gross	$87,758	$59,024
Net after taxes	58,903	39,824
Balance after charges	31,099	19,233
Balance after note interest	29,634	17,743
Surplus after dividends	9,084	6,959

FORT WORTH POWER & LIGHT.

	1914.	1913.
May gross	$ 72,724	$ 50,091
Net after taxes	35,386	32,108
Surplus after charges	25,629	25,374
12 months gross	773,984	560,057
Net after taxes	436,728	299,753
Surplus after charges	341,741	229,792
Balance after preferred dividends	280,355	186,392

PACIFIC GAS & ELECTRIC.

	1914.	1913.
Four months' gross	$ 5,839,660	$ 5,485,324
Operating expenses, taxes and maintenance	2,942,490	3,049,318
Net earnings	2,897,170	2,436,006
12 months' gross	15,556,673	15,178,889
Operating expenses, taxes and maintenance	9,206,378	8,645,491
Net earnings	7,350,295	6,533,398

CONSUMERS POWER OF MICHIGAN.

	May, 1914.	5 Mos.
Gross earnings	$260,773	$1,425,569
Net after taxes	172,048	953,409
Surplus after charges	78,191	485,942
Balance after preferred dividends	48,191	345,942

For the 12 months ended May 31, 1914, gross earnings were $3,269,291, net earnings $1,906,258, surplus after charges $822.629, and balance after dividends $490,129, an increase of 8.38 per cent over the balance for the 12 months ended May 31, 1913.

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	June 29.	June 22.
American Tel. & Tel. (New York)	122¼	123⅜
Commonwealth Edison (Chicago)	135	136¾
Edison Electric Illuminating (Boston)	249	250
Electric Storage Battery common (Philadelphia)	51	51
Electric Storage Battery preferred (Philadelphia)	51	51
General Electric (New York)	146½	147⅞
Kings County Electric (New York)	119	120
Massachusetts Electric common (Boston)	11	11¼
Massachusetts Electric preferred (Boston)	59	60
National Carbon common (Chicago)	117	115
National Carbon preferred (Chicago)	120	119½
New England Telephone (Boston)	129½	131
Philadelphia Electric (Philadelphia)	25	25¼
Postal Telegraph and Cables common (New York)	79	80
Postal Telegraph and Cables preferred (New York)	66	67¼
Western Union (New York)	57	58¼
Westinghouse common (New York)	74½	76
Westinghouse preferred (New York	123	124

PERSONAL MENTION.

MR. C. M. MEANS, of Pittsburgh, Pa., has been appointed consulting electrical engineer with the United States Bureau of Mines.

MR. GUS A. KOHLER, auditor for the Springfield, Troy & Piqua Electric Railway Company, was married to Miss Carrie Gunther, of Wapakoneta, on June 23.

MR. F. M. FARMER, chief engineer of the Electrical Testing Laboratories, New York City, is making a trip through the West visiting the company's clients and familiarizing himself with conditions in that part of the country.

MR. WILLIAM MITCHELL, of Wichita, Kans., has been appointed chief engineer of the municipal electric light plant at Coffeyville, Kans., succeeding MR. CHRIS REHM, who has taken the position of chief engineer with an Oklahoma institution.

MR. H. E. DAVIS, traffic manager of the Home Telephone Company, of Joplin, Mo., has been appointed traffic manager of the Kansas City Home Telephone Company. The promotion was effective July 1. Mr. Davis has had a long connection with Missouri and Kansas telephone concerns, having been with both the Topeka, Kans., and St. Joseph, Mo., companies.

MR. WILLIAM McCLELLAN, formerly chief of the division of light, heat and power for the Public Service Commission, Second District, New York, has been appointed confidential engineer of the commission in connection with the physical valuation and investigation of the New York Telephone Company, for which provision was made by the last Legislature.

MR. M. A. HUTCHISON, who has been intimately associated with MR. THOMAS A. EDISON for the past four or five years, was awarded the degree of Doctor of Philosophy by the Society of Jesuits at Spring Hill College, Spring Hill, Mobile, Ala., on June 17. Although Dr. Hutchison is not a Roman Catholic, he attended Spring Hill in the early nineties, and this year delivered the baccalaureate sermon.

MR. A. N. FOX, advertising manager of the Benjamin Electric Manufacturing Company, Chicago, Ill., has been elected president of the Executives Club of Chicago. Mr. Fox is a well recognized authority on technical advertising and the training of executives for the development of expert knowledge in the handling of the details of a technical business. At the great convention of the Associated Advertising Clubs of America, held at Toronto last week, Mr. Fox preached the lay sermon, opening the convention on Sunday morning and participated in several of the departmental sessions during the week.

MR. ALBRECHT F. LEUE has resigned as purchasing agent of the Triumph Electric Company, Cincinnati, O., and will enter upon the practice of law. Mr. Leue was born in Cincinnati in 1877 and graduated from Hughes High School in 1894 and the University of Cincinnati in 1898. He entered the employ of the Triumph Electric Company in January, 1900, being engaged successively in the stock, correspondence and advertising departments, and for the last eight years has been purchasing agent of the company. He studied law at the Night Law School of the Young Men's Christian Association and was admitted to the Ohio bar in 1905. Mr. Leue will engage in the general practice of law, giving special attention to commercial and corporation work.

MR. JOHN SANDBERG, special appliance salesman of the General Electric Company, has returned to Salt Lake City, Utah, from a month's work in Idaho where he has been co-operating with MR. JULIUS DERGE, in charge of appliance sales for the Utah Power & Light Company, in an extensive selling campaign of electric ranges and cooking appliances. They visited practically all of the important towns on the Utah Power & Light Company's system in southern Idaho and carried with them a complete equipment which was set up at some convenient store or hall, for demonstration purposes. Their coming had been extensively advertised by the company's local representatives and the patrons from the town and from the surrounding territory came in great numbers to witness the demonstration. Messrs. Derge and Sandberg express complete satisfaction with the results secured. A great many orders were taken for ranges and for heating and cooking appliances and much interest was stimulated among the well-to-do farmers, which will undoubtedly result in sales later on.

DR. WILLIAM DAVID COOLIDGE, assistant director of the Research Laboratory of the General Electric Company, at Schenectady, has been awarded the Rumford Medal of the American Academy of Arts and Sciences. The award is for the invention of ductile tungsten and its application in the production of radiation. Dr. Coolidge perfected a process whereby the metal tungsten may be drawn into the fine wire threads, now familiar in the new type of incandescent lamps. Another striking invention of Dr. Coolidge is the adoption of tungsten for anode and cathode in the X-ray lamp, resulting in a ray of greater penetrative power and one that may be regulated in its intensity. Dr. Coolidge was born at Hudson, Mass., in 1873. He received the degree of Bachelor of Science from the Massachusetts Institute of Technology in 1896, and the degree of Doctor of Philosophy from Leipsic in 1899. Before going abroad he was for one year assistant in physics at the Institute, and again on his return in 1899 and in 1900. He remained at Massachusetts Tech until 1905, being successively instructor and research assistant in theoretical chemistry and physical chemistry, and the last year was assistant professor of physico-chemical research. He was selected by Willis R. Whitney, director of the Schenectady Laboratory, himself a technology graduate of 1890 and also a Ph. D. from Leipsic, for assistant in the General Electric laboratory, where he became assistant director in 1908.

OBITUARY.

MR. HAROLD BELKNAP, who was sent to Spain some time ago by the General Electric Company, as its representative, died of smallpox there, according to word just received by friends in this country.

MR. ISIDOR WORMSER, a noted banker of New York, nephew of the late Isidor Wormser, also a banker, died of pneumonia at Sospel, a town in the Alpes-Maritimes, near Nice, France, on June 23. Mr. Wormser, who was 45 years old, retired several years ago. Shortly after his uncle's death in 1907, he became a partner in W. E. Lauer & Company. The Wormsers had been identified with the operation of the Metropolitan Street Railway Company. When the New York City Railway was formed they brought suit to cancel the lease of the Metropolitan.

MR. SANFRED D. ELIASON, lamp clerk of the Utah Light & Railway Company at its commercial office on Main Street, Salt Lake City, Utah, died on June 18, of spinal meningitis with which he had been suddenly attacked about 10 days before. While the original attack was very severe he apparently recovered in good shape from it and had most excellent prospects for complete recovery when he suffered a second attack which proved fatal. He entered the company's employ as a messenger boy four years ago. He was of a studious disposition and by strict attention to business had received several well merited promotions.

DATES AHEAD.

Missouri Electrical Contractors' Association. Annual convention St. Louis, Mo., July 11. Secretary, A. J. Burns, Kansas City, Mo.

National Electrical Contractors' Association of the United States. Annual convention, Cadillac Hotel, Detroit, Mich., July 15-18. Secretary, G. H. Duffield, 41 Martin Building, Utica, N. Y.

Ohio Electric Light Association. Annual convention, Cedar Point, O., July 21-24. Secretary, D. L. Gaskill, Greenville, O.

Southeastern Section, National Electric Light Association. Annual convention, Isle of Palms, Charleston, S. C., August 19-21. Secretary, A. A. Wilbur, Columbus, Ga.

American Peat Society. Annual meeting, Duluth, Minn., August 20-22. Secretary, Julius Bordello, 17 Battery Place, New York, N. Y.

New England Section, National Electric Light Association. Sixth annual convention, Narragansett Pier, R. I., September 2-4. Secretary, Miss O. A. Bursiel, 149 Tremont Street, Boston, Mass.

Pennsylvania Electric Association. Annual convention, Eagles Mere, Pa., September 8-11. Secretary, S. E. Pohe, Bloomsburg, Pa.

American Institute of Electrical Engineers. Pacific Coast convention, Spokane, Wash., September 9-11. Secretary, F. L. Hutchinson, 29 West Thirty-ninth Street, New York, N. Y.

Association of Edison Illuminating Companies. Annual convention, White Sulphur Springs, W. Va., September 14-17. Secretary, George C. Holberton, San Francisco, Cal.

International Association of Municipal Electricians. Annual convention, Atlantic City, N. J., September 15-18. Secretary, C. R. George, Houston, Tex.

Illuminating Engineering Society. Annual convention, Cleveland, O., September 21-25. Secretary, Joseph D. Israel, 1000 Chestnut Street, Philadelphia, Pa.

American Electrochemical Society. Twenty-sixth general meeting, Niagara Falls, N. Y., October 1-3. Secretary, Joseph W. Richards, South Bethlehem, Pa.

Electric Vehicle Association of America. Fifth annual convention, Philadelphia, Pa., October 19-21. Secretary, A. J. Marshall, 29 West Thirty-ninth Street, New York, N. Y.

With the Electrical Manufacturers

Simplex Wire & Cable Company, Boston, Mass., has recently issued a 16-page booklet on Simplex steel-taped cable. This booklet describes briefly the manufacture and uses of the cable which is protected by two steel tapes wound spirally in reverse directions. It also illustrates and describes the methods of installing steel-taped cable in ornamental lighting systems, in parks, in the grounds of public buildings, and in railroad and manufacturing yards. It discusses the severe voltage tests to which the cable is subjected and shows the saving that can be effected by using this type of underground construction.

Titan Storage Battery Company, Newark, N. J., has recently issued a bulletin illustrating and describing Titan storage batteries for electric vehicles, lighting and ignition systems, and for use with the self-cranking type of gasolene cars. The parts of the battery are fully described and a number of pages are devoted to the elementary theory of the storage battery, storage-battery measurements, etc. Numerous curves and drawings, and excellent color reproductions showing the construction of the batteries and their plates are included. A few pages of the bulletin are devoted to the organization and purposes of the company.

The Connecticut Telephone & Electric Company Incorporated had as the culminating feature of the mid-summer meeting of its sales force a rather unique but very successful form of entertainment. After an automobile trip down the beautiful Connecticut valley and dinner at the old village of East Haddam, a search of an old wine cellar was made, where vintages as old as 1846 were discovered and sampled. At the dinner, President Wilcox and General Manager Lawton outined the expansion in manufacturing facilities, that have been made necessary by the enormous increase of business due to the manufacture of the new Connecticut Automatic Igniter System and the Ford Master Vibrator. For several months the factory has been forced to work day and night to keep up with its orders.

Universal Electric Stage Lighting Company, Kliegl Brothers, proprietors, 240 West Fiftieth Street, New York, has prepared an attractive wall poster, 28 by 41.5 inches, showing many of the Kliegl connectors and plugs. Full-size reproductions are shown of 26 of these devices, which are used for stage, battery-charging, sign and miscellaneous connecting and plugging; the garage plugs break at any angle. The company is also distributing to its patrons copies of a handy diary and notebook; this contains the calendars of 1914 and 1915 and diary blanks for the remainder of this year and all of next year, also other memoranda blanks. Much valuable information is also included on Klieglight and other arc projecting lamps, stage pockets, plugs and connectors, stereopticon equipment, dimmers, signs, border and footlights, and special stage electrical effects.

National Metal Molding Company, Pittsburgh, Pa., has recently issued loose-leaf bulletin No. 100, which illustrates and describes "National" metal molding and fittings. All moldings and fittings are shown by excellent cuts, and prices and shipping data are included. Among the new fittings listed in this bulletin are sub-bases Nos. 423 and 424 which are adapted for use with porcelain receptacles and rosettes, fitting No. 424 being of the angle type. Several new 3.5 and 4.5-inch keyless receptacles, two-piece rosettes and fixture rosettes are among the new fittings. These are made in the metal-cap box-cover type, and in the all-porcelain box-covered type, and are adapted for use with conduit-box outlets and on straight molding work. Metal-cap and porcelain box-cover receptacles and metal-cap box-cover cord and fixture rosettes are also among the new products of this company. Several new types of clamps for metal molding are also included, the clamps being of the single and double plain types, of the strap type and screw hole and of the single and double baseplate types. Bulletin No. 150, which has also been recently issued, is devoted to "Sheraduct," "Economy" and "Flextube" conduit and "National" locknuts and bushings. Bulletin No. 200, illustrates and describes "Flexsteel" armored cable and lamp cord, metallic flexible conduit and fittings. Both bulletins give prices and shipping data.

Western Electric Company, New York City and Chicago, has published two valuable pamphlets, of which the one entitled "The Making of the Voice Highways" is written in nontechnical language and very attractively illustrated. It describes in a popular way the making of lead-covered telephone cables, pointing out first the need for this type of line circuit. The description includes even the production of the raw materials, copper, manilla paper and lead, and their manufacture into wire, insulated, twisted and stranded; the drying and testing of the core and its covering with the lead sheath is graphically told; the final testing to insure highest quality is explained, as also the facilities for making special cables to order quickly. Nearly 50 illustrations make the text still more clear. The company has also published a new catalog of its Inter-phones and accessories. This is a 48-page book containing brief descriptions and a multitude of diagrams and half-tone illustrations of twelve intercommunicating telephone systems. These range from the simple two-station sets to the extensive equipments installed in large offices, mercantile or industrial establishments, hospitals, schools and other institutions, apartment houses, palatial residences, etc. Many wiring and schematic diagrams are given. A great variety of accessories and supplies are also listed in the catalog.

General Electric Company, Schenectady, N. Y., has received the following among a large number of recent orders for power equipment: Phillips Insulated Wire Company, Darlington, R. I., two 750-kilowatt Curtis turbogenerators with a 17.5-kilowatt exciter set, regulator equipment and a switchboard. Buffalo, Rochester & Pittsburg Railway Company, Du Bois, Pa., a 525-kilowatt Curtis turbogenerator, a 400-kilowatt motor-generator set, a 75-kilowatt alternating-current generator, two three-kilowatt exciters, two 37.5-kilowatt transformers and a switchboard. Apsley Rubber Company, Hudson, Mass., a 400-horsepower induction motor, 50-kilowatt transformer and a starting panel. Creese & Cook, Danversport, Mass., a number of 35-horsepower, 50-horsepower and 75-horsepower motors and a switchboard. Husted Milling Company, Buffalo, N. Y., one 15-kilowatt and two 200-kilowatt transformers, and 26 motors ranging from five horsepower to 100 horsepower. American Optical Company, Southbridge, Mass., a 1,250-kilowatt Curtis turbogenerator. Nairn Linoleum Company, Newark, N. J., a four-ton electric storage-battery industrial locomotive. Harris Clay Company, Micaville, N. C., a 75-kilowatt alternating-current generator with three-kilowatt exciter, two 10-kilowatt and four 20-kilowatt transformers, one 15-horsepower and two 20-horsepower induction motors and a switchboard. Chicago & Western Indiana Railroad Company, Clearing, Ill., 69 motors ranging from two horsepower to 50 horsepower. Singer Manufacturing Company, New York City, a 100-kilowatt rotary converter and switchboard. Atlantic Refining Company, Philadelphia, Pa., three 100-horsepower induction motors. William R. Thropp & Sons Company, Trenton, N. J., a 300-horsepower induction motor with controller and oil switch. Phoenix Portland Cement Company, Nazareth, Pa., a 140-kilowatt synchronous motor, 150-kilowatt alternating current generator, two 200-kilowatt transformers and a switchboard. The Ottumwa Sand Company, Ottumwa, Ia., a 150-horsepower induction motor with base and controller. H. W. Johns-Manville Company, New York City, 100-horsepower and two 50-horsepower induction motors. Union Carbide Company, Niagara Falls, N. Y., several 50-horsepower and 150-horsepower induction motors. Cardive Gypsum Company, Ft. Dodge, Ia., 18 motors ranging from three-horsepower to 52-horsepower. Silica Milling Company, Silica, O., two 60-horsepower induction motors. Forsythe Furniture Company, Winston-Salem, N. C., 27 motors ranging from one-horsepower

to 20-horsepower. Atol Gas & Electric Company, Templeton, Mass., a 300-kilowatt rotary converter. Cohoes Company, Cohoes, N. Y., three 9,000-kilowatt alternating-current waterwheel-driven generators, two 165-kilowatt two-unit three-bearing motor-generator sets, four 400-kilowatt transformers, four automatic feeder regulators, switchboard and accessories. Newell Water & Power Company, Newell, W. Va., a 300-kilowatt Curtis turbo-alternator. Southern Power Company, Greenwood, N. C., three 2,000-kilowatt oil-cooled transformers. Keno Power Company, Keno, Ore., a 450-kilowatt alternating-current generator with 20-kilowatt exciter, two 300-kilowatt transformers and a switchboard. Cambria Steel Company, Johnstown, Pa., two 500-kilowatt rotary converters and six 175-kilowatt transformers. American Bridge Company, Pittsburgh, Pa., a four-ton electric storage-battery industrial locomotive. Aluminum Ore Company, East St. Louis, Ill., twelve 15-horsepower induction motors and compensators. Forged Steel Wheel Company, Butler, Pa., eight 105-horsepower mill-type motors. Hartford Machine Screw Company, Hartford, Conn., four 75-horsepower induction motors. Riter-Conley Manufacturing Company, Pittsburgh, Pa., six centrifugal gas compressors. Bourne-Fuller Co., Cleveland, O., a 200-kilowatt motor-generator set and switchboard. Southwark Foundry & Machine Company, Philadelphia, Pa., a 425-horsepower induction motor and controller. Dobbie Foundry & Machine Company, Niagara Falls, N. Y., 13 induction motors ranging from five-horsepower to 50-horsepower, three 2,300-volt transformers and accessories. Cambria Steel Company, Johnstown, Pa., a 375-horsepower induction motor and compensator. American Iron & Steel Manufacturing Company Lebanon, Pa., three 200-horsepower, five 300-horsepower and one 400-horsepower mill-type motors.

Record of Electrical Patents.

Issued by the United States Patent Office, June 23, 1914.

1,100,721. System of Ship Propulsion. W. L. R. Emmett, assignor to General Electric Co. An alternating-current generator and motor ship-propulsion system. (See cut.)

1,100,723. Potential-Indicator. E. F. Gehrkens, assignor to General Electric Co. A line-drop compensator and contact-making voltmeter.

1,100,731. Trolley. G. W. Hamilton, assignor to Westinghouse Electric & Mfg. Co. A two-swivel trolley pole.

1,100,736. Transformer-Tank Breather. A. Hundt, assignor to General Electric Co. An oil trap.

1,100,744. Trolley-Wire Splice. W. H. Kempton, assignor to Ohio Brass Co., Mansfield, O. A bolted splicing device.

1,100,748. Speed Regulator. H. A. Laycock, assignor to General Electric Co. Speed-controlled contacts adjust field resistance.

1,100,749. Manual Call Distributing System. J. H. Levis, Jr., assignor to Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y. Covers details for a telephone system.

1,100,767. Signal Apparatus. H. F. Newbury, assignor to Elevator Supply & Repair Co., Chicago, Ill. A floor-lamp signal system for elevators.

1,100,786. Control Apparatus. W. M. Scott, Radnor, Pa. Worm gears of motor gearing are solenoid-controlled.

1,100,792. Trolley-Wire Hanger. N. W. Storer, assignor to Westinghouse Electric & Mfg. Co. An elliptical-strap yielding hanger.

1,100,817. Semi-Automatic Signal Mechanism. R. G. Balcaen, assignor to General Railway Signal Co., Gates, N. Y. A track-operated electric signal.

1,101,832. Electric Flat-Rate Controller. F. Kraemer, assignor to M. Harris, Pittsburgh, Pa. Has means for opening circuit on overload.

1,100,836. Automatic Fire Extinguisher. G. W. Lorimer, Piqua, and A. G. Stouder, Troy, O. Motor rotates fire extinguisher.

1,100,856. Telephone System. A. R. Tucker, Lott, Tex. Covers details of switchboard apparatus.

1,100,857. Electrical Appliance. S. B. Van Ranst, and M. Havens, Jr., Albany, N. Y., said Van Ranst assignor to Crouse-Hinds Co., Syracuse, N. Y. A conduit lamp receptacle. (See cut.)

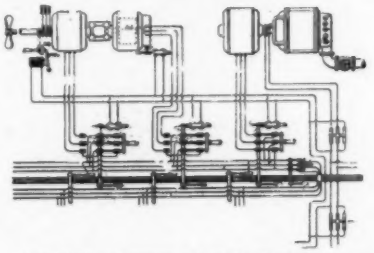
1,101,859. Line-Wire Fastener. T. A. Wiseman, Winchester, Tenn., assignor of one-half to R. T. Wiseman. A pair of clamping members is affixed to the insulator.

1,100,860. Electric Indicator System. E. Wood, assignor to Charles Cory & Son, Inc., New York, N. Y. An electrically operated indicator.

1,100,880. Illuminating Device. P. M. Hotchkin, assignor to National X-Ray Reflector Co., Chicago, Ill. A combination indirect and direct portable lamp.

1,100,883. Watts-Per-Candle Photometer. H. E. Ives, assignor to United Gas Improvement Co., Philadelphia, Pa. In series with standard and test lamps are devices controlling the illumination of the opposite secondary sources.

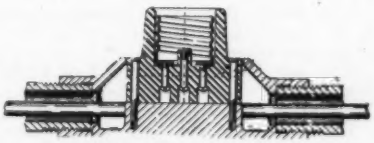
1,100,895. Means for Influencing the Variations of Magnetic Fields. F. G. Liljenroth, Vesteras, Sweden. Dynamo has main and auxiliary field windings.



1,100,721.—System of Ship Propulsion.

1,100,949. Switch. S. F. Briggs, assignor to Briggs & Stratton Co., Milwaukee, Wis. A drum controller.

1,100,957. Circuit Closer. A. L. Davis, Clinton, S. C. A track-operated switch.



1,100,857.—Conduit Receptacle.

1,100,960. Trolley Wheel. E. U. Down, assignor to Down Trolley Supply Co., Toledo, O. Has a brush contact member.

1,100,964. Motor Controller. C. T. Evans, assignor to Cutler-Hammer Mfg. Co., Milwaukee, Wis. Has a number of interlocked control handles.

1,100,993. Contact for Electric Furnaces. F. T. Snyder, Oak Park, Ill. A contact holder having a spirally grooved water chamber.

1,100,994. Door for Electric Furnaces. F. T. Snyder. Covers details.

1,100,995. Electric Furnace. F. T. Snyder. Covers details of roof structure.

1,100,997. Apparatus for the Production of Ozone. J. Steynis, assignor to Steynis Ozone Co., New York, N. Y. An electric ozone machine.

1,100,999. Dash Set for Motor Vehicles. G. R. Wadsworth, assignor to Peerless Motor Car Co., Cleveland, O. An automobile lighting set.

1,101,009. Electric Circuit Closing Device. W. W. Burke, Bennington, Vt., assignor of one-fourth to J. E. Burke and one-fourth to A. J. Cooper. A mechanically remote-controlled switch.

1,101,014. Flaming-Arc Attachment for Inclosed Arc Lamps. H. G. Dyer, assignor to V. M. Stevenson, Philadelphia County, Pa. Covers details of condensing chamber, which can be attached to ordinary arc lamp.

1,101,016. Electric Car heater. T. Farmer, Jr., assignor to Consolidated Car-Heating Co., Albany, N. Y. Covers arrangements of heating coils.

1,101,018. Signaling circuit for Train Dispatching System. J. C. Field, assignor to Western Electric Co., New York, N. Y. A selective signaling system.

1,101,027. Transformer. S. E. Johannesen, assignor to General Electric Co. Covers method of strapping core to casing.

1,101,036. Railway Traffic-Controlling Apparatus. B. F. Oler, assignor to Union Switch & Signal Co., Swissvale, Pa. An electric signal system.

1,101,039. Railway Traffic Controlling Apparatus. G. R. Scattergood, and H. A. Wallace, assignors to Union Switch & Signal Co. Railway crossover signal.

1,101,040. Railway Traffic-Controlling Apparatus. G. R. Scattergood and H. A. Wallace, assignors to Union Switch & Signal Co. A direct-current signal system.

1,101,050. Means for Operating Liquid Electric Controllers and Starters. R. F. Baerlocher, Brighton, England. A liquid motor controller.

1,101,051. Alternating-Current Distributing System. G. Berry, assignor to General Electric Co.'s Switch mechanism for controlling a supplementary transformer.

1,101,055. Electrical Apparatus. T. A. C. Both, assignor to I. S. Rosenheim, New York, N. Y. A flush receptacle.

1,101,056. Burglar Alarm. G. A. Brewster, New York, N. Y. A window or door contact.

1,101,058. Insulating Supporting Means. F. E. Case, assignor to General Electric Co. A third-rail insulator.

1,101,064. Electrical Switch. J. F. Dana, assignor of one-half to W. W. Wright. A drum controller.

1,101,067. Electric Interlocking Circuits. W. F. Follett, assignor to Union Switch & Signal Co. A railway traffic signal.

1,101,068. Railway Traffic-Controlling Apparatus. W. F. Follett, assignor to Union Switch & Signal Co. A modification of No. 1,110,067.

1,101,069. Alternating-Current Motor. V. A. Fynn, assignor to Wagner Electric Mfg. Co., St. Louis, Mo. A repulsion motor.

1,101,072. Electric Heater. W. S. Hadaway, Jr., New York, N. Y. A thermometer-controlled heater.

1,101,078. Device for Generating a Sterilizing Gas. R. A. Kiefer, Ramsey, N. J. Fits ordinary lamp socket and contains liquid subjected to electrolysis. (See cut.)

1,101,095. Electromagnet. J. N. Reynolds, and H. D. Hill, assignors to Western Electric Co. An electromagnetic bell.

1,101,127. Electric Current-Control Safety Device. L. T. Hatfield, Sacramento, Cal. For a transmission system.

1,101,130. Telephone Pay Station. G. A. Long, assignor to Gray Telephone Pay Station Co. Covers details.

1,101,133. Selective Signaling System. J. J. Lyng, assignor to Western Electric Co. A telephone party-line signaling system.

1,101,137. Spark Plug. A. P. Melanson, Lynn, Mass. Covers details.

1,101,148. Apparatus for the Production and Strengthening of Electrical Vibrations. J. Schiessler, Baden, Austria-Hungary. Means for regulating and controlling an electric arc.

1,101,175. Aerial for Wireless Telegraphy. E. Girardeau, Paris, France, assignor of one-half to J. Bethenod. A flat-top antenna in which the horizontal part is employed mainly for increasing the wave-length.

1,101,197. Means for Starting Alternate-Current Mercury-Vapor Lamps. R. Kuch, assignor to General Electric Co. Covers details of starting arrangements.

1,101,210. Temporary Insulator. C. W. Potter and A. F. Van Deinse, Albuquerque, N. Mex. An insulator for breaking meter contacts.

1,101,214. Method of and Apparatus for Operating Electric Motors. W. Siebenmorgen, assignor to C. & C. Electric & Mfg. Co. A series control system.

1,101,254. Circuit-Controlling Apparatus. P. E. Collins, Boston, Mass. A solenoid controller.

1,101,256. Electrical Igniting Apparatus. W. H. Cotton, Chicago, Ill. Covers details of contact arrangements.

1,101,272. Electric Switch. P. E. Gilling, East Orange, N. J. A small lever switch.

1,101,278. Apparatus for the Electrical Purification of Water. H. B. Hartman, Philadelphia, Pa., assignor of one-half to G. A. Dunning. For the electrolysis of water.

1,101,281. Insulating Coating and Method of Forming and Applying the Same. H. B. Holmes and J. W. Harris, assignors to Western Electric Co. An insulating coating comprising ozocerite and castor oil subjected to destructive distillation.

1,101,284. Trolley Harp. A. J. Howe, Hartford, Conn., assignor of one-half to H. McCrodden. Covers details of wheel support.

1,101,289. Electric Socket and Connector. G. C. Knauff, Chicago, Ill. A sliding-contact lamp socket for automobiles.

1,101,299. Safety Train Device. L. Long, Kansas City, Kan. A trip for operating the air brakes is controlled by the track circuit.

1,101,326. Indicating Device for Phonography and its Application. M. De Pezzer, Paris, France. Has key-controlled electromagnetic means for impressing on a band, a graphic record for indicating rhythm.

1,101,360. Electrode Terminal for Electric Heaters. U. Tobler, assignor to firm of Brockdorff-Witzenmann M. B. H., Berlin, Germany. Has fluid-tight insulated joint with body of heater.

1,101,369. Railway Signal. H. S. Williams and L. G. Wilson, Columbia, S. C. A battery-operated signal.

1,101,078.—Electric Sterilizer.

1,101,376. Lamp receptacle. R. Abbott, assignor to Bryant Electric Co., Bridgeport, Conn. A recessed lamp receptacle.

1,101,384. Anti-Sparking Device for Dynamo-Electric Machines. L. A. Auvert and A. F. E. Ferrand, Paris, France. Covers details of field windings.

1,101,429. Automatic Annunciator. J. H. Genter, Newburgh, N. Y. A time-clock arrangement.

1,101,447. Electrical Method of Welding. E. H. Jones, London, England. Method for welding tubes.

1,101,448. Electrical Welding Apparatus. E. H. Jones. A modification of No. 1,101,447.

1,101,452. Automatic Ticket-Registering System. Alexander Kiparski, St. Petersburg, Russia. Electromagnetically controlled.

1,101,453. Apparatus for Automatically Totalizing Tickets. A. Kiparski. An electromagnetic counting device.

1,101,491. System for Producing High-Frequency Currents. E. Girardeau and J. Bethenod, Paris, France. A combination of oscillating circuits.

1,101,494. Automatic Switch for Flashers, etc. G. F. Kirchhoff, assignor to M. Harris, Pittsburgh, Pa. Covers details.

1,101,495. Flat-Rate Controller. F. Kraemer, assignor to M. Harris. A current regulator.

1,101,503. Apparatus for Removing Snow and Ice from Rails. D. C. Joyce, Philadelphia, Pa., assignor of one-half to F. D. Thomason. Has electric heater for melting ice or snow.

1,101,511. Automatic Train Stop or Signal Device. O. A. Ross, Chicago, Ill., assignor of one-half to C. V. Kasson. Interlocking electric signal circuits.

Patents Expired.

The following United States electrical patents expired June 29, 1914.

585,171. Burglar-alarm system. W. T. Arnold, Chicago, Ill.

585,185. Earth Conductor or Ground-Wire Attachment. H. M. Crane, Boston, Mass.

585,249. Electric Clock. R. Baumann and T. H. Wurmb, St. Louis, Mo.

585,250. Combined Electric Fan and Electrolier. E. H. Bennett, Jr., Bayonne, N. J.

585,255. Contact-Box for Electric Railways. W. M. Brown, Johnstown, Pa.

585,257. Electric Meter. F. P. Cox, Lynn, Mass.

585,258. Electric Metering Apparatus. F. P. Cox.

585,267. Electric Trolley Device. A. J. Gairing, Johnstown, Pa.

585,293. Electric Contact Device. S. H. Stahl, Johnstown, Pa.

585,307. Electric Dynamo or Motor. C. E. Emery, Brooklyn, N. Y.

585,308. Electric Broiler. G. B. Fraley, Denver, Colo.

585,309. Electric Heater. G. B. Fraley.

585,310. Alternating-Current Electric Heater. G. B. Fraley.

585,311. Electric Heater. G. B. Fraley and A. B. Paulson, Philadelphia, Pa.

585,316 and 585,317. Electric Arc Lamp. P. H. Klein, Jr., New York, N. Y.

585,318. Electric Arc Lamp. E. Lavens, Brooklyn, N. Y.

585,319. Telautograph. L. O. McPherson, Highland Park, Ill.

585,321. Insulating Joint. L. F. Van De Wiele, Brooklyn, N. Y.

585,342. Electric Train-Signal. M. W. Parrish, Detroit, Mich.

585,350. Bracket for Incandescent Lamps. H. Noreck, Charlottesville, Va.

585,379. Dynamo-Electric Machine. G. E. Dorman, Chicago, Ill.

585,444. Rheostat and Circuit-Controller. H. W. Leonard, East Orange, N. J.

585,472 and 585,473. Secondary Battery. G. E. Hatch, Quincy, Mass.

585,480. Electric Time-Alarm. A. C. Roebuck, Chicago, Ill.

585,507. Circuit-Breaker for Electric Wires. A. J. Clark, Lexington, Ky.

585,511 and 585,512. Circuit-Controller for Electric Motors. H. H. Cutler, Chicago, Ill.

585,527. Electric Motor. C. Lindberg, Duluth, Minn.

585,560. Electric Telephone. C. F. Dunderdale, Chicago, Ill.

585,579. Trolley for Electric Cars. J. C. Kellogg, Lexington, Ky.

585,602. Trolley for Electric Railways. V. Thelin, Geneva, Switzerland.

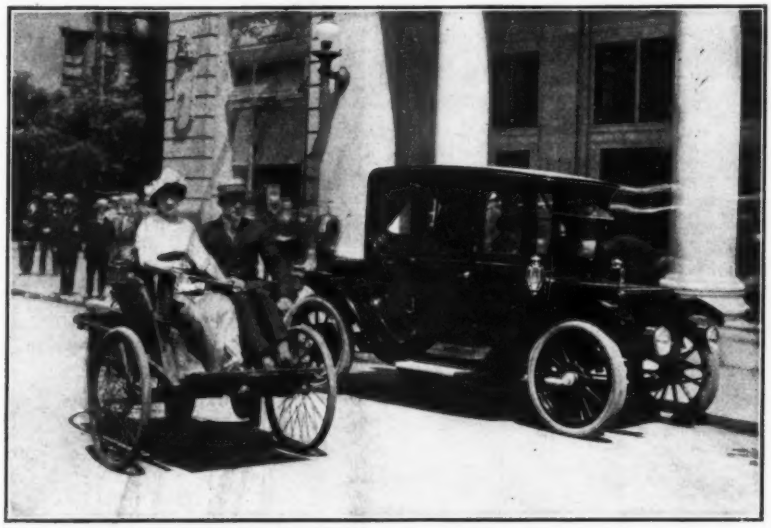
585,603. Electric Arc Lamp. C. J. Toerring, Jr., Washington, Pa.

585,620. Electric Accumulator System. H. B. Cox, Hartford, Conn.

Electric Vehicle Section

The Old and New Electric Vehicles Contrasted.

There is a newcomer in the New York Electric Vehicle Association's exhibition at the showrooms of the New York Edison Company, in New York City. Although a newcomer, it is one of the ancestors of all the electric vehicles on exhibition and consequently is warmly welcomed among its many highly polished descendants. There is no more vivid way of presenting the wonderful progress in electric vehicles than by contrasting this ancient contrivance and the perfectly molded modern electric automobile. The "grand-daddy" of all electric vehicles has just been presented to the New York Electric Vehicle Association by L. S. Mendel, who years ago bought it from a stranger who had been interested in a company formed to manufacture electric vehicles. The machine was built in 1893 and still has the same pneumatic tires that were put on when it was made. It is an oddly wrought three-wheeled contraption, steered with a tiller by a single wheel in the rear, like the rudder on a ship. There are only two speeds and the machinery is set on the front axle. The storage battery is carried under the seat and in the body. The name of the inventor is not known. His idea was to have a light, efficient battery, with as light a frame as possible. His main object seems to have been in obtaining speed. When the outfit arrived at the exhibition, it was rigged up for service and tried out before a curious crowd of onlookers. At the same time, a modern electric pleasure car was brought out by way of contrast and to show the last word in electric vehicle perfection.



Old and New Electric Vehicles Contrasted.

Gala Night at Electric Vehicle Association Meeting in New York.

The last regular monthly meeting of the Electric Vehicle Association prior to the summer season, was held on Friday, June 19, in the Auditorium of the Consolidated Gas Company, Irving Place and Fifteenth Street, New York City. The meeting was in the nature of a "Gala Night." Business was largely dispensed with, the audience of some five or six hundred enthusiastic "boosters" for electric vehicles being entertained by a very elaborate program, staged under the direction of Clarence L. Law, of the New York Edison Company.

The performance was by strictly amateur talent supplied by the Yonkers Electris Light and Power Company, the United Electric Light & Power Company, Edison Storage Battery Company, Westchester Lighting Company, Public Service Electric Company, Electric Storage Battery Company, and the Philadelphia Section of the Electric Vehicle Association of America.

TOURING BY ELECTRIC AUTOMOBILE.

By J. S. Codman.

Has the day of the electric touring car arrived? Or if not, how far distant is it and what must yet be done to hasten its coming?

We cannot yet say that the day has come, but on the other hand it is now close at hand and the obstacles still in the way are neither many nor great.

Already the electric has ceased to be merely a town car. In addition, it is now the ideal runabout both for city and country work. It is more convenient, more dependable, more comfortable and cheaper to operate than a gas car, and within the last few years has been so developed that actual road runs of 70 to 100 miles have been made at a speed considerably greater than the usual road speed of the gas car.

Last summer a tour of between 500 and 600 miles was made in an electric through the Green Mountains of Vermont and the White Mountains of New Hampshire, and no difficulty was experienced either on the steep hills nor on the rough or sandy country roads. The distance from Boston to Burlington, Vt. (258 miles) was made at an average running speed of 19 miles per hour. The slowest run was from Keene, N. H., to Springfield, Vt., 42 miles, 16.7 miles per hour and was made almost entirely after dark. The fastest section covered was from Boston to Fitchburg, 21.3 miles per hour. The 78 miles from Rutland to Burlington (including detours) was made at exactly 20 miles per hour.

An even more notable run was made last October from Boston to Chicago during the worst weather of the season which turned many of the roads into sloughs of almost impassable mud, but again no greater difficulty was experienced than might be expected with any car under such circumstances.

Some of the data of this trip is given below and especial attention is called to the high daily mileage and high average speed obtained whenever fair conditions of road were encountered.

The car left Boston October 14, arriving in New York the next day, where it was then exhibited for three days at the Electrical Show. It started for Chicago, October 19, and ran some part of every day, with the exception of Sunday,

October 26, when a rest was taken at Cleveland.

The minimum daily mileage was 18 between Albany and Schenectady, following the failure of the garage in Albany to properly charge the car; and the maximum daily mileage was 173.5 between Syracuse and Buffalo, where good roads and good weather were in combination. An average speed of 20 miles per hour was readily attained under fair conditions, while between Springfield and New Haven it was 23.6 and between Rochester and Buffalo, 22.8. The average speed for the whole distance is obtained by dividing the total miles, 1,302.5, by the total hours consumed in running between points; viz., 83.5 hours. This gives an average speed of 15.6 miles per hour, which is certainly remarkable considering that no time at all is taken out for road stops.

The latest remarkable trip in an electric automobile was made in the early part of June, and for the first time on record an electric automobile left Boston and arrived in New York in less than 24 hours.

If, then, the electric automobile is not lacking in speed and is fully capable of meeting all road conditions, what then is the obstacles to its use for touring? As is evident everywhere it is the difficulty in getting charged on the road. This difficulty, however, is not to any great extent a difficulty inherent in the car itself. It is true that a battery cannot be filled as quickly as a gasoline tank, but on the other hand, the delay is not great if proper facilities can be obtained. Boosting a battery at high current rates is perfectly practical today. The Edison battery is notable in this respect and lead batteries, it is now understood, can be charged without injury at much higher rates than was formerly thought possible, if only proper care is taken to reduce the rate before the gassing point is reached.

I have myself, on one occasion, out on the road, boosted a battery at 200 amperes for one hour. This battery was composed of Edison A-6 cells rated at 45 amperes normal current and it absorbed in that hour enough charge to have carried me about 50 miles. On this occasion my cable was passed through the window of the electric light station and connected directly on the exciter bus and very little time was lost in getting connected.

In touring, however, an opportunity such as the above is seldom offered. Usually much time is lost in getting connected and the ampere rate obtainable is usually low. It is this inability to get satisfactory charging service which is the one great obstacle to touring in an electric. Public charging stations are few and far between and when found are as a rule equipped with a hopelessly inadequate 30 or 40-ampere rectifier. On the other hand, if you go to the electric plant itself where there is ample power you will nearly always find those in charge totally unprepared and you can only be accommodated if someone in authority happens to be on hand and only then after much time consumed in getting ready. It is not practical to spend an hour getting ready to begin a half-hour's boost.

The overcoming of this great obstacle to touring with an electric is something we must leave largely in the hands of our central station friends. Generally speaking, they are most willing to help when an emergency arises, but this does very little real good. What is needed is apparatus all ready for use and someone about the premises who knows what ought to be done.

Now, of course, there are central stations which provide ample and convenient charging facilities, but they are very exceptional. In most of the small towns and even in many large cities proper facilities for charging are either nonexistent or are very inadequate.

It would certainly seem that where there is in a town no public charging station capable of giving an adequate boost, at least 100 amperes at 125 volts, the electric light company itself should have ready for use a service connected with the exciter bus. This service should consist of a switch, fuses and terminals for connecting to the cable and charging plug which every motorist should himself carry. A cheap resistance coil for controlling the current, it would also be best to have ready, but often even this is unnecessary especially when the Edison battery is used, measuring instruments are not necessary, as it is the service rather than the amount of current which should be charged for, and further an approximate measurement can usually be made by means of the instruments on the car itself. Such an outfit would be very inexpensive.

Now in the face of records of this kind, it is time for the central-station man to do his part, and if he cannot arrange a neat little installation of battery-charging equipment by using his exciter for this service at a cost which is too small to consider he must be indeed lacking in enterprise. It ought not to be necessary for an electric automobilist to telephone ahead from a point several hours' run away in order to secure the required charge on arrival. We are inclined to think that most central-station men will go out of their way to accommodate the cross country driver of an electric automobile in the particular rare instances when such a machine comes along but what is really needed is a readiness-to-serve policy which will make the purchase of a charge as simple a matter as the buying of five or ten gallons of gasoline from the village grocery—a continuous availability of the charging apparatus at all hours and at a fair price. With the increase of day service even among the smallest central stations the time has passed for indifference or sluggishness in the matter of being ready to charge vehicle batteries at 2 a. m. as well as at 6 p. m. through simple home-made flexible connections and resistances whose cost is nominal. Of course, the electric automobiles will not come until the small central station is prepared to charge them; the latter must get into line and be ready for the business; the ultimate profits are clear to the student of electric-vehicle development.

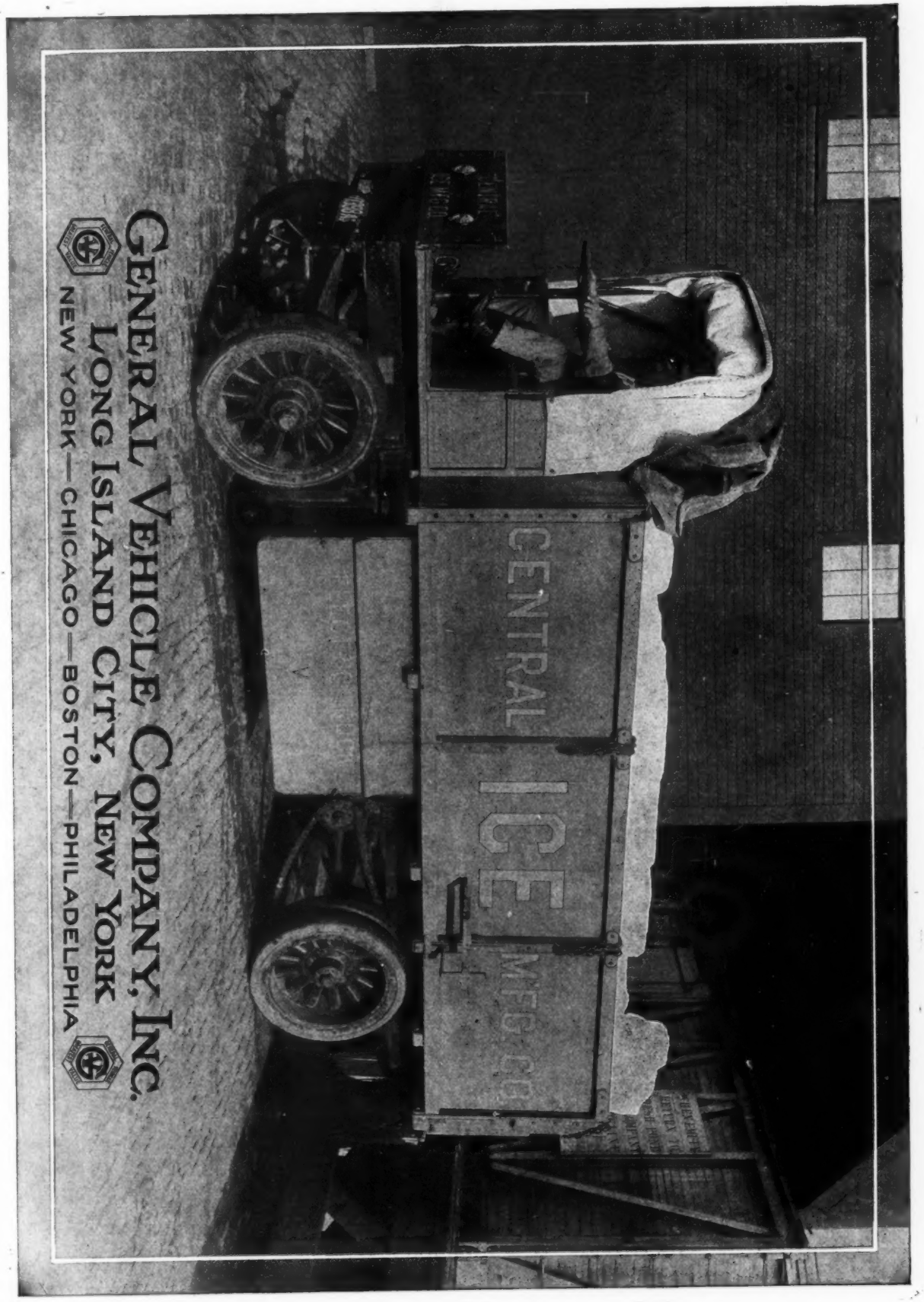
RUNS MADE BY VARIOUS ELECTRIC AUTOMOBILES ON ONE CHARGE OF BATTERY.

	Miles	Time	Average Speed
Boston to Pawtucket, R. I., and return (78 miles); remainder of run about Boston	103.2	5:07.5	20.14
Boston to Springfield	93.4	4:55	19.00
New Haven to New York	78.4	3:51	20.4
Rochester to Buffalo	77.0	3:45	20.5
Brookline and Groton, Mass., and return	74.0	4:01	18.4
Springfield, Mass., to New Haven, Conn	66.1	2:48	23.6
Boston to Wareham	58.0	2:47	20.8
Worcester to Springfield	51.7	2:08	24.2
Boston and Fall River	49.9	2:37	19.1
Geneva to Rochester, N. Y.	46.0	2:01	22.8
Brookline and Amesbury, Mass., via Haverhill	45.0	2:12	20.5
Boston and Worcester	42.5	1:46	24.0
Boston to Lowell, Mass.	25.9	1:12	21.6
Springfield, Mass., to Hartford, Conn	27.3	1:03	26.0
Brockton to Boston	21.8	1:05	20.2

BOSTON-CHICAGO TOUR IN ELECTRIC ROADSTER, OCTOBER, 1913.

SUMMARY OF DAILY MILEAGE.

October.		Miles.
14	Boston to New Haven	161.0
15.	New Haven to New York	78.4
19.	New York to Albany	150.3
20.	Albany to Schenectady	18.0
21.	Schenectady to Syracuse	129.8
22.	Syracuse to Buffalo	173.5
23.	Buffalo to Erie	104.3
24.	Erie to Ashtabula	45.0
25.	Ashtabula to Cleveland	59.6
27.	Cleveland to Fremont	86.3
28.	Fremont to Wausem	67.3
29.	Wausem to Kendallville	64.6
30.	Kendallville to South Bend	61.0
31.	South Bend to Chicago	103.4
		130.5



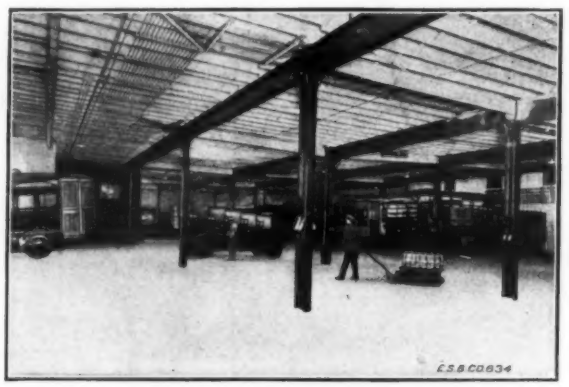
GENERAL VEHICLE COMPANY, INC.
LONG ISLAND CITY, NEW YORK
NEW YORK—CHICAGO—BOSTON—PHILADELPHIA

A New Public Garage for Electrics in New York.

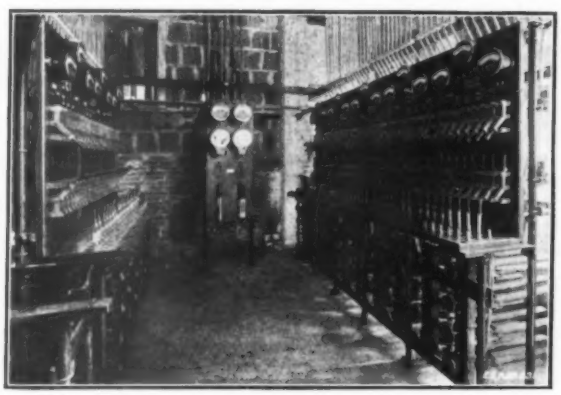
That the electric vehicle business is growing in New York City is apparent from the fact that a new and improved public garage, where electric vehicles may be stored, charged and maintained, has recently been located in that city. The rapid increase in the number of electric vehicles, particularly in the commercial field, has caused the Exide Battery Depots Company, Incorporated, to open a new and modern garage to meet this demand. After careful consideration, a convenient and centrally located garage on the west side of town was decided upon, and this new west side garage and Exide Battery depot has now been put into service. It is located at 527 to 541 West Twenty-third Street, on the north side of the way between Tenth and Eleventh Avenues. That a real need for this enterprise existed is evidenced by the fact that many owners of electric vehicles immediately availed themselves of the service provided and the new garage has been well patronized since the date of its opening, early in January of this year.

The West Side Garage is the largest and most completely equipped public garage in New York City, the space available for vehicle storage totaling some 20,000 square feet and making provision for the convenient location of more than 100 vehicles, all on the ground floor, a most desirable feature, eliminating the delay and annoyance caused by raising the vehicles from the street level by elevators, etc. The building is of fireproof construction and adequate artificial lighting and ventilation

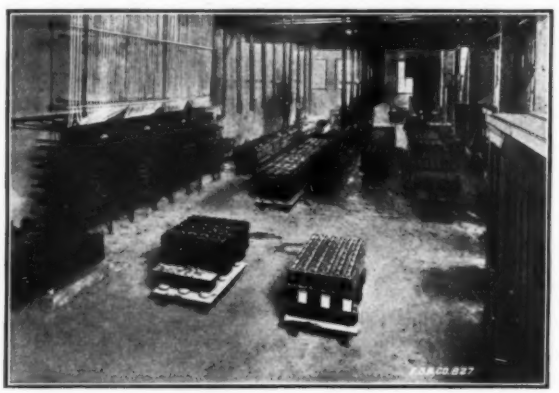
General Offices, Exide Battery Depot Garage, New York City.



Interior, Exide Depot, All Electric Garage.

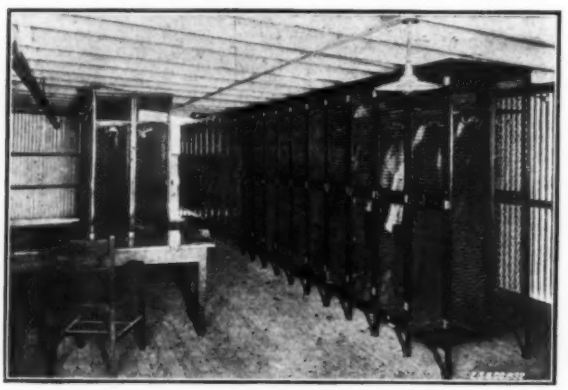


Battery Charging Switchboard.



Battery Receiving Room.

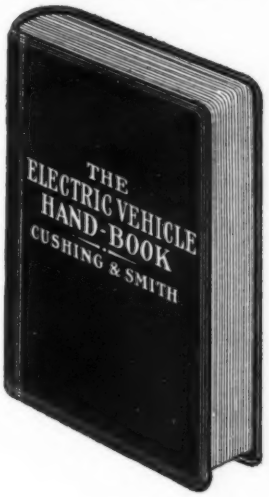
Superintendent's Room.



Locker Room.

The Only Book on the Electric Vehicle Published

"The Electric Vehicle Hand-Book"



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Fellow of the American Institute Electrical Engineers

FRANK W. SMITH
President Electric Vehicle Association of America

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VIII.—Wheels, Rims and Tires; Their Care.
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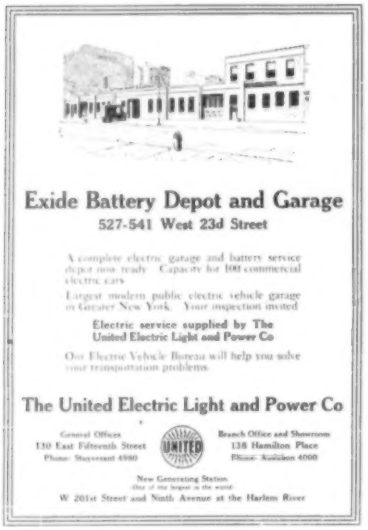
are provided by 20 large skylights. The floor of the garage is of concrete, sloped so that the entire room is perfectly drained. Charging facilities are complete in all details, the equipment being up-to-date in every respect. Vehicles can be charged in place, avoiding all shifting for charging purposes. The charging circuits are of liberal capacity and installed in the most approved manner. The standard charging plug, as adopted by the Electric Vehicle Association of America, is included in the equipment. Control of the charging equipment is centered in a main switchboard specially designed for the purpose and so arranged as to insure that charging is done in the exact manner necessary to produce the best possible results in vehicle and battery operation. This part of the work is under the immediate supervision and control of men who have no other duties and who have been carefully trained and are expert in this important department of garage work.

The importance to the vehicle owner of having his truck, delivery wagon or passenger vehicle charged and cared for under proper conditions is now rather fairly understood. The difference in maintenance cost and operating reliability and satisfaction that may easily result from improper attention, as compared with adequate and proper service in this department, is very great. Included within the equipment is a hydraulic lift for handling underslung batteries.

The superintendent's office is centrally located, being raised above the main garage floor with ample windows and open space providing an unobstructed view of the entire premises. A complete checking system for all returns, a safe for the care of valuables,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An Example of Central-Station Co-operation.

Exterior of New West Side Garage, Exide Battery Depot, New York.

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And Starting the Third Lap 10% above Rated Capacity

Truck No. 37 of the Chicago Commonwealth Edison Company has been operated constantly for 4 years and has traveled over

50,000 Miles — **Equivalent to twice around the earth**

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The original Battery of 60 A-6 Edison cells installed in Truck No. 37 in 1909 with a rated capacity of 225 ampere hours is still operating it and gave on bench test a few weeks ago 247½ ampere hours. During the four years the Electrolyte was renewed twice. **There were no other renewals or repairs of any kind** on the battery. Another Edison Storage Battery in similar service is just entering its **sixth year.**

Mr. Edison is still waiting for a properly installed Edison Battery to show signs of giving out.

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a time clock, etc., are provided among other details.

The drivers' waiting room is equipped with individual lockers and ample washstand and toilet facilities are arranged in convenient proximity.

The "Exide" Battery Depot.

Immediately adjoining the garage on the east and separate from the main building, is located the battery depot. This depot in common with others maintained by this same company, the Exide Battery Depots Company, Incorporated, which are located throughout the larger cities of the United States, is completely equipped for the assembly of new and the overhauling and rebuilding of used "Iron Clad" and "Exide" batteries. A specialty is also made of general repair work of every description that has to do with the electric vehicle and its accessories.

A commodious assembly and repair room permits the work to be done under very advantageous conditions and from a well-stocked storeroom on the second floor supplies and battery parts may be furnished and delays avoided. The general offices are located on the second floor. F. F. Sampson is the manager in charge, with an efficient force of assistants. The garage of the company located on the east side of town, 141 to 147 East Twenty-fifth Street, where accommodations are provided for 80 vehicles, is also under the direction of Mr. Sampson.

In their location, size and equipment and in the manner in which it is hoped to conduct the business of these two garages, there is a striking illustration as to the position which the electric vehicle has taken in the transportation field in New York City, and it is hoped that through intelligent management and satisfactory service, that the electric vehicle will find a constantly increasing field of application.

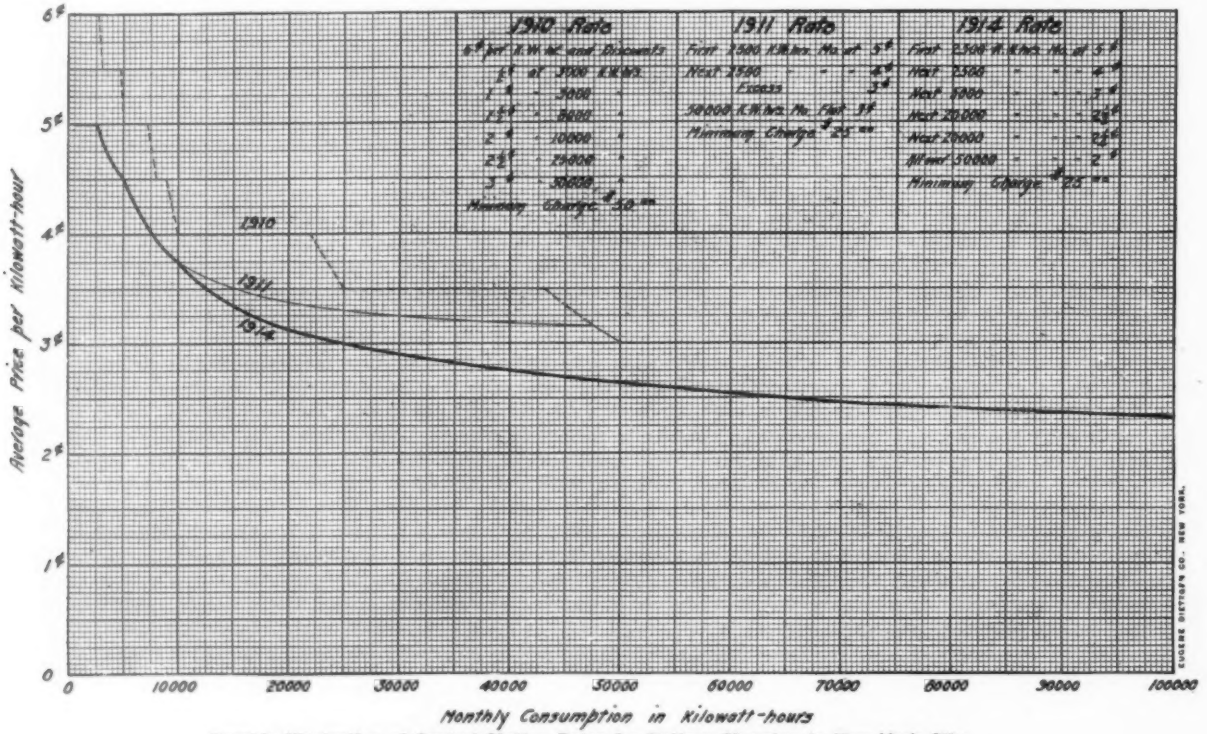
A number of views are presented of the garage, both exterior and interior.

Central-Station Co-Operation.

Realizing the fact that the local New York central-station companies were co-operating in every way with the vehicle manufacturers and others for the benefit of the electric vehicle industry, the electric service required not only for charging facilities, but as well for lighting purposes and the miscellaneous power requirements, was contracted for with the New York Edison Company for the East Side Garage, which has been in service for some time, and with the United Electric Light & Power Company for the new West Side Garage here described. The service for this latter garage is supplied from an adjacent substation of the United Electric Light & Power Company, it being possible in this instance to supply from motor-generator sets direct current at 105 and 120 volts. The lighting service is supplied at 60-cycle, single-phase, 110 volts, the power service being of two-phase characteristics. While the garage is not yet fully up to its capacity, the amount of current so far indicated shows a consumption of about 25,000 kilowatt-hours per month.

The United Electric Light & Power Company has undertaken to assist the garage company in securing business by conducting a local publicity campaign. One piece of copy is shown which speaks for itself. In addition to this the garage has been brought by follow-up letters to the attention of all electric vehicle manufacturers, as well as to the attention of users of electric vehicles, who might avail themselves of the modern facilities offered by this garage.

As an indication as to what the local central-station company is doing in the matter of rates for storage-battery charging, a curve is herewith reproduced which shows graphically the rates at which storage battery current has been furnished by the company for the past three years, the prevailing rate as indicated by the heavy face line having been put into effect the first part of May. As will be seen, this new and lower rate takes into account the advantage of the larger consumption of current for this character of business, coming as it does on the "off peak" load and presenting other advantages to the central-station company. This same rate has been adopted by the New York Edison Company, and every effort is being made by these two companies to foster the growth of the electric vehicle interests, not only for commercial, but for pleasure purposes as well.



Graphic Illustration of Central-Station Rates for Battery-Charging in New York City.